LE TRAINING FOR WAR

By

Lt. Col. S. W. BROOKHART
Infantry, U. S. A.

Published by the

TIONAL RIFLE ASSOCIATION OF AMERICA

FOR THE

NATIONAL BOARD FOR THE PROMOTION OF RIFLE PRACTICE

SECOND EDITION
Revised and Enlarged

WASHINGTON
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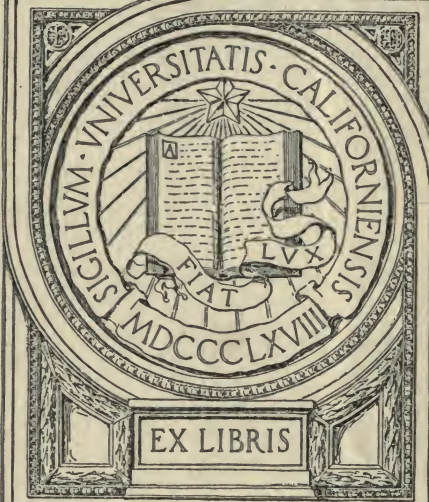
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WASHINGTON, IOWA, *June 9, 1919.*

This is the second edition of "Rifle Training in War." The first was written prior to the Small Arms Firing School at Camp Perry, Ohio. In that school and later in the Infantry School of Arms at Camp Benning, Ga., I received many valuable suggestions from Col. Morton C. Mumma and all of the excellent corps of instructors. Those entitled to special mention and credit for this edition are Capt. Don A. Preussner, Capt. James M. H. Wallace, Capt. Arthur D. Rothrock, and Lieut. John A. Dietz.

SMITH W. BROOKHART,
Lieutenant Colonel of Infantry, United States Army.

FOREWORD.

THE THEORY OF INDIVIDUAL FIRE.

THE armistice is signed and peace is coming, but rifle training in peace is not different from rifle training in war. The one is reasonable preparation, the other immediate necessity. Both have the same object when we are considering military training. This training may be divided into two parts: First, the training of the individual; second, the training of the leaders and their units in collective fire.

It is the purpose of this publication to treat only of individual training, and it will begin with a discussion of its theory and relative importance. Before the war there grew up a theory, based largely upon German precept if not propaganda, to the effect that individual rifle training was unimportant if not a military detriment. It was variously stated that "Expert riflemen will not make as many hits in war as will average shots"; that "Individual instruction should not be given at ranges greater than 500 yards"; that "Such training as the soldier receives on the target range plays but a minor part"; that "At 900 yards poor marksmen will obtain 10 times as many hits as good marksmen"; that "When the range is unknown the superior skill of the excellent marksman works to his positive disadvantage"; and that, firing in modern battle, is "often conducted at ranges of 2,000 yards or even more."

These conclusions were demonstrated by various firing problems. One of the favorites was to organize four companies of 48 men each. The first was experts, the second average shots, the third poor shots, and the fourth recruits. These companies in turn were halted 1,200 yards from a line of targets and were required to set their sights with a 12 per cent error or approximately 150 yards wrong. Each then fired 10 shots per man and it was found the experts got no hits. They missed the targets about 150 yards just as their sights were set. The average shots scattered their fire a little and got a few hits. The poor shots scattered their fire more and got more hits. The recruits scattered their fire most and got most hits. The experts were then taken on an estimating-distance test and their average error was about 12 per cent. They were then informed that the distance given them was exactly in accordance with their own error and the result of their firing was the same as in battle. The result proved that poor marksmen would get 10 times as many hits as good marksmen at long ranges and that superior skill was a disadvantage when the distances were unknown. Hence, individual instruction should not be given at greater ranges than 500 yards and target-range training plays but a minor part.

If the problem were exactly like a battle and if battles must be fought exactly like the problem, then the conclusions would be correct, but neither side ever did or ever will act like the problem. The enemy will not march up and halt in a line at 1,200 yards to be smashed by a scatteration of poor rifle shots. If he did take such a position, the intelligent thing to do would be to use machine-gun fire. If expert riflemen must be used they would not waste 10 rounds of

ammunition in obedience to an erroneous estimate of distance. A trial shot or a trial volley would set them right. The distance would not remain unknown if they were experts. If they were poor shots the correctness of the distance would matter little. They get about the same number of hits, right or wrong. In either case they do not get enough to be decisive, and the shorter the distance the more unreliable they become. There are other conditions of modern warfare that entirely destroy the arguments against the individual training on the target range. The development of the machine gun has certainly taken over most of the long-range collective fire that was formerly assigned to the rifle. This is true even in open warfare. On the other hand, the best defense or offense against the machine gun is in the training of more and better snipers.

In trench warfare the advance by platoon rushes protected by rifle fire is impossible. Most of the advancing is done underground and in the night. The collective fire of the preliminary battle advances is entirely discarded. When the time comes to go over the top, the whole line goes over together, either under the protection of a barrage or as a surprise without artillery preparation. The range is usually very short, nearly always under 400 yards. After the mêlée starts there is no such thing as fire distribution, fire control, or even fire discipline. In the decisive stages of the fight commands are impossible and communications cease. There is nothing left to rely on except the individual training of the man. If that has been good, the fire control will be good, because each man will save his fire until he can hit something. When the

enemy appears he needs no command to deliver his fire both rapidly and accurately. He will look through the sights, and that means hits and superiority of fire. Misses never give superiority, however great the volume. A great volume of misses encourages the enemy. At these short ranges if the men are properly trained they will accurately know every distance. Even if the distances must be estimated the errors will not cause trained riflemen to miss. A 12 per cent error in distance at 300 yards only raises or lowers the hit 3 inches in the vertical plane, and that would not miss a head. Notwithstanding these facts the whole history of warfare shows that the ordinary army does less execution at the short ranges than at the longer ranges. There are two reasons: the excitement of battle and insufficient individual training. If the training is thorough a large percentage of the men will go back to it in spite of the excitement of battle. If the training is inadequate, the excitement sends the shots high and the ammunition is wasted.

In a quiet sector it has been said that a rifle shot would not be heard in many days. If such is the fact the sector was not properly organized with trained snipers. In any quiet sector the snipers ought to dominate the ordinary situation, and that in spite of machine-gun fire. Such a result can not be obtained without the best trained individual riflemen. It can surely be obtained with them.

If the modern battle ranges are so short, that fact may be urged as a reason why target training should not be done at a greater distance than 500 yards. Such a reason will appeal only to the novice. The good rifleman learned his 500-yard holding at 1,000

yards. He learned more in firing one shot at the longer range than in firing five at the shorter. If he is trained in the harder problem he masters the other with ease and he saves both time and ammunition. The distance should be increased as rapidly as he can hit and change his hits to correspond to his sight changes. Greater improvement at the shorter ranges is sure to follow this kind of training. Besides, every sniper should be trained to hit at 1,000 yards and even at greater distances with telescopic sights.

It is said that individual training will not insure proper fire distribution. If the warfare were open and there were no machine guns, then the spraying of the landscape would of necessity be done with the rifles. The question of fire distribution would then be of great importance. But since we have machine guns the commander would not be justified in exposing a long line of riflemen and shooting away their ammunition when one or two machine guns would do the job better. The machine gun has very greatly reduced the necessity for collective rifle fire and for its systematic distribution even in open warfare. However important the training for these purposes might have been in the past, it dwindles under modern conditions. We have reached the time when an exhaustive study should be given of the proper coordination and division of fire as between machine guns, automatic rifles, and rifles. The occasions and conditions under which each should be used should be carefully analyzed and defined and the training modified accordingly. If the machine gun is taking the place of our old collective fire problems at long distances, it is time to drop so many of them and save that much of our troubles.

When we come to the shorter distances and the more decisive stages of battle, individual training will cause each man to fire on the enemy he is approaching, and that insures the best posible distribution along the whole line. Besides, we have already seen there is nothing else to rely upon at this stage.

From the foregoing discussion it is deduced that individual training in rifle fire is of the greatest importance in war. The discipline that is so necessary for proper teamwork in battle is best attained by training in the work itself. The morale that is so necessary to sustain the shock of battle is best developed by the confidence each man has in his ability to do execution with his weapons.

If this training were properly given it would be divided into three stages. First, the ordinary target range practice at known distances in which every aid to speed and accuracy should be employed. It is possible to give this part of the training quite efficiently in a 16-week period and without neglect of other training, but not upon the ammunition allowance of the firing manual. A plan is outlined in part 13 hereof which would train 2,000 instructors in 24 half days of firing and then each man in the division for 12 half days under these instructors. This would require about 800 rounds of ammunition per man, and every shot would be fired under the direction of a trained instructor. This is a minimum. Every man who is sent into a modern battle is certainly entitled to this amount of preparation. It is less training than he would get in learning to shoe a horse or drive an automobile. It is less than he will get in many minor parts of his military instruction. It can be done with

a reasonable number of targets, but it has not been done heretofore. This training will not make a war shot out of any man, but it will give him the best basis for it. If possible he should have a second period of training on indistinct and moving targets at unknown distances, but it is a waste of time to attempt this before a man has learned the rifle and the hold in a reliable manner. Also, no satisfactory range for training large numbers of men in this kind of fire has yet been developed. Small sniper ranges have been operated with reasonable success, but the proper solution on a large scale is yet to come. This would end individual training and the third stage is collective fire. The leaders only can be trained in collective fire. The large terrain and the time required make it impossible to train the whole personnel. If the leaders become casualties the whole training is lost. It is, therefore, obvious that the principal reliance can not be put upon training in collective fire. If the individual is well trained the machine will always go; if he is not, it is always in danger of collapse.

AN OUTLINE FOR INDIVIDUAL TRAINING.

THE course of instruction in marksmanship is comprised of 20 subjects, which will be referred to by number, as follows:

1. Nomenclature, dismounting and assembling rifle.
2. Care and cleaning rifle.
3. Position drills.
4. Manipulation drills.

5. Sight alignment.
6. Trigger squeeze.
7. Ten commandments.
8. Aiming drills.
9. Rapid loading.
10. Rapid-fire aiming drills.
11. Sight setting.
12. Gallery practice.
13. Range operation.
14. Records.
15. Exterior ballistics.
16. Safety cautions.
17. Range firing.
18. Functioning and repairs.
19. Interest and enthusiasm.
20. Daily critique and review.

Each student should be provided with—

Rifle, cleaning rods, oil, and patches.
Automatic pistol.
Notebook.
Score book and pencils.
Grease.
Cartridge belt and 20 dummy cartridges.

Reference books for use of students—

Small-arms firing manual.
Hand Book of the Rifle. War Department publication (Doc. No. 698).
Ordnance publications. (Nos. 1923, 1917, 1966, 1965, 1793, and 1992.)
Blanks used by this school.

1. NOMENCLATURE, DISMOUNTING AND ASSEMBLING RIFLE.

(A) Have group dismount and assemble bolt mechanism in concert.

(*a*) Display parts to group and ask individual members for correct names.

(*b*) Have individual students describe function of each part.

(B) Have group dismount and assemble magazine mechanism.

(*a*) Ask individuals for correct names.

(*b*) Ask individuals for description of functions of each part.

(C) Instructor will dismount and assemble the whole rifle in presence of his group.

(*a*) Will ask individuals correct name of each part.

(*b*) Will ask individuals for description of the function of each part.

(D) Instructor will designate three vital parts of the rifle, as follows:

1. Lands at the muzzle:

(*a*) Minimum gauge, 0.2999.

(*b*) Worn-out gauge, 0.304.

(*c*) Difference, 0.0041.

(*d*) Maximum amount of wear on each individual land $\frac{1}{2}$, or 0.00205.

(*e*) Maximum gauge, 0.302—subtracted from worn-out gauge leaves, 0.002.

(*f*) 0.001 minimum amount of wear on each individual land bring $\frac{1}{2}$.

(*g*) The average diameter of a human hair is 0.0015, which is about the average amount of wear on the rifle land until it is worn out. Gauge figures are for 1917 rifle, but they illustrate for any rifle.

The above figures are fractions of an inch.

2. Guard screws:

(*a*) Must always be tight.

(*b*) If rifle becomes erratic examine guard screws first.

(*c*) Explain delicacy in vibration of barrel.

(*d*) Explain delicacy in bending barrel.

(*e*) Explain bearing of barrel on guard screws.

3. The trigger:

(*a*) The command.

(*b*) The heel, or final squeeze bearing.

(*c*) No drags, creeps, or stops in final squeeze.

(*d*) Drags, creeps, and stops corrected by shortening and smoothing heel bearing.

(*e*) After heel is shortened it may be necessary to shorten and smooth command bearing on side toward heel.

(*f*) The two bearings must be kept separate and distinct.

(*g*) Sear nose and sear must never be filed to correct for drags, creeps, and stops in the final squeeze.

(*h*) Test I and II, Small Arms Firing Manual.

(E) Comparison of service rifles.

2. CARE AND CLEANING OF RIFLE.

(A) Cleaning rack.

(B) Cleaning patches.

(C) Oil.

(D) Grease used on bullets in firing makes cleaning easy.

(E) Pull-through should not be used generally; it has a tendency to injure the lands at the muzzle.

(F) Use of emery dust prohibited.

(G) All muzzle cleaning prohibited.

(H) Fouling, powder or metal.

(I) Powder fouling removed by ordinary soda solution.

(J) Metal fouling prevented by use of greased bullets. It may not be advisable to use them in battle because of smoke, but they should be used during the training period for the preservation of the rifle.

(K) Ammonia solution for metal fouling has done many times more damage than good, because it has not been properly used. If used it must be with the greatest care and exactly as prescribed in the descriptive book.

(L) After all cleaning, the bore must be oiled.

(M) For a short time the best oil is sperm mixed with 20 per cent cosmoline.

(N) For a long period, cosmoline.

(O) If rifles are inspected clean and shining, they must be oiled immediately and inspected a second time after oiling.

(P) Orders will not get rifles oiled after shining inspection; there must be another inspection to see that the orders are obeyed.

3. POSITION DRILLS.

(A) Regular positions of the firing manual and trench:

(*a*) Prone.

(*b*) Sitting.

(*c*) Kneeling.

(*d*) Standing.

(*e*) Standing trench.

(B) Sling adjustments:

(*a*) Prone position, without sandbag.

(*b*) Sitting position.

(*c*) Kneeling position.

(*d*) Standing position.

(*e*) In standing and kneeling position arm may be wrapped in sling without going through the loop, known as the grapevine sling.

(C) Sandbag adjustments:

(*a*) Prone, with sling, hand on bag, rifle on hand.

(*b*) Prone, without sling, bag under explosion; easiest position and almost as good.

(*c*) Standing trench, without sling, bag under explosion.

(*d*) Best not to use sling in standing trench position.

(*e*) Test VIII, Small Arms Firing Manual.

4. MANIPULATION DRILLS.

(A) Manipulate bolt with trigger tied back.

(B) Simulate aiming by taking the aiming position; but this is not an aiming drill.

(C) Begin manipulation in standing position because it is easiest.

(*a*) Then kneeling.

(*b*) Then sitting.

(*c*) Then prone, and in the sling.

(D) Final test, 20 times in 15 seconds in prone position, in sling, with trigger tied back.

5. SIGHT ALIGNMENT.

(A) Relative position of sights and bull's-eye.

(*a*) Freeze face to stock in such position that top of front sight appears in center of peep.

(B) Focus of the eyes.

(*a*) Will only focus on one point at same time.

(*b*) Sight alignment checked by changing focus of eye from center of peep to top of front sight, then to bull's-eye. It may be necessary to repeat this check several times.

(*c*) Focus on peep held on sky line discloses—

(1) Bright center in peep.

(2) Dark center in bright center.

(3) Bright point in dark center.

(*d*) Bright point is optical center of peep, but it is hard to find, and is only found when eye is right distance from the peep, and variation of one-half inch too close or too far from the peep loses it. The first big bright center noticed in a peep can be used in practically all aiming and centering whether on the sky line or not. The others are not seen in 1903 rifle, because sight is too far from eye.

(C) Sighting devices.

(*a*) Belgian aiming device.

(*b*) Sighting bar.

(*c*) Ordnance aiming device.

(*d*) Only value of these devices is to assist in learning correct sight alignment. As soon as understood they have no further use.

(D) Sighting triangles.

(*a*) Tests at 100 yards, triangle covered by quarter dollar.

(*b*) Sight triangle in bright light.

(*c*) Shade target and note effect of dark light.

(*d*) Shade sights, leave target bright; note effect.

(*e*) Shade both sights and target; note effect.

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(*f*) After men become expert at sighting triangles, have groups of three or more sight triangles without moving rifle or target. Note different placing of triangles by different men, hence difference in eyes.

(*g*) Have same done in different light, and note difference in effect of light on different eyes.

(E) Test VI, Small Arms Firing Manual.

6. TRIGGER SQUEEZE.

(A) Command hold.

(B) Final squeeze.

(C) Flinching:

(*a*) Caused by fear of explosion.

(*b*) Or improper placing of mental attention.

(*c*) Cured by training the mind to stay where it belongs.

(*d*) Mind should not think of explosion.

(*e*) Mind should think of sight alignment and final squeeze.

(*f*) Mixing dummies with loads will not cure flinching, and is so dangerous it should be prohibited.

7. TEN COMMANDMENTS.

1. Position 45°.
2. Adjust sling high.
3. Hard on shoulder.
4. Freeze face to stock.
5. Hold breath.
6. Take command trigger.
7. Align sights.
8. Last focus on bull.
9. Final squeeze.
10. Call shot.

(A) The commandments are based on the prone position because it is the best position in which to learn accurate shooting.

(*a*) The alignment of the body 45° from the alignment of the rifle is the best prone position for accurate shooting, and should, therefore, be used during the training period, although it may not often be possible in battle. The best positions bring the best results, and when good shooting is once learned it will follow in any position that may be forced by service conditions.

(B) Sling should be adjusted high above the muscle of the upper arm and held with the keeper.

(*a*) If permitted to slip down near the elbow three-fourths of its value is lost.

(*b*) The sling should be used when possible, because it gives the best results.

(*c*) After good holding, and with the sling, all holding without it will be improved.

(*d*) Many times in battle the sling can not be used, but its lessons are valuable anyhow.

(C) If the sling is adjusted high, and the right length, the butt of the stock will come hard against the shoulder.

(D) There can be no good holding unless the face is frozen hard against the stock, and also against the thumb when it goes around the stock.

(*a*) This freezing of the face should be in such position as to bring the eye in proper alignment with the sights, as already noted.

(E) The breath must be held:

(*a*) At the time of alignment.

(*b*) During final trigger squeeze.

(*c*) The best way is to catch up breathing, take a long breath, exhale part until feeling is easy, and then hold as above indicated.

(*d*) If breath can not be held long enough for this at first trial, above process should be repeated.

(*e*) Attempt should always be made to complete the aim and trigger squeeze on the first holding of the breath.

(F) After the trigger is squeezed back a certain distance there is a distinct stop. To take command of trigger means to squeeze it back to this stop and hold it there. This should be done before alignment of sights and final squeeze.

(G) Correct sight alignment is:

(*a*) Top of front sight in center of peep.

(*b*) Top of front sight at 6 o'clock under bull's-eye, or on other aiming point.

(H) The eye having two sights and an aiming point, or bull's-eye, to observe, must focus at least three different times, and the last focus before the final squeeze is on the bull's-eye or aiming point.

(I) After the last focus on the bull's-eye or aiming point has shown the sights in proper alignment with it, everything is ready for the final squeeze of the trigger, which must be prompt and steady, without thinking of the explosion.

(J) After the final squeeze the next business of the mind is to call the shot, which is done by observing the position of the front sight at the time of final squeeze.

(*a*) If top of front sight is higher than it should be at aiming point, shot is called high.

(*b*) If top of front sight is to right of aiming point at time of final squeeze, shot is called to the right.

(*c*) The same for left.

(*d*) The same for low.

8. AIMING DRILLS.

(A) The ten commandments indicate the ten things to do in an aiming drill, and all aiming drills should be conducted with the same care as shooting to hit.

(*a*) Conduct the aiming drill by using the ten commandments as commands.

(B) Test IX, Small Arms Firing Manual.

9. RAPID LOADING.

(A) Training in rapid loading with dummies is usually neglected. For this reason it was made a leading subject in this instruction. This must be practiced until each student becomes expert.

(*a*) With dummies.

(*b*) Test VII, Small Arms Firing Manual.

10. RAPID-FIRE AIMING DRILLS.

(A) Rapid-fire aiming drills are the same as the ten commandment aiming drills, except the speed is increased to rapid-fire time. After rapid-fire time is mastered the maximum rate per minute may be used.

(*a*) They should be conducted first without dummies.

(*b*) With dummies.

(*c*) Test X, Small Arms Firing Manual.

(*d*) Care to prevent injury from dummies.

11. SIGHT SETTING.

(A) Corrections should be estimated in inches from the center of the bull's-eye. One point of wind will move a hit 4 inches for each 100 yards distance from the target and in the same direction that the wind gauge is moved. One hundred yards elevation will move a hit on the target in inches equal to the square of the number of hundred yards distance.

(B) Table of exact movement of hits is found at top of page 73, description and rules for 1903 rifle No. 1923. When battle sight is used this windage must be increased by approximately one-third.

(C) Corrections for finding the target when missing should be for one-half the height of target for elevation and one-half the width for windage.

(D) Average speed of wind is estimated over the whole ground and the wind gauge is moved into the wind as shown by the second table, page 73, No. 1923.

(E) 12 and 6 o'clock winds affect only the elevation and the effect is slight at the short and mid ranges. At 1,000 yards 25 yards of elevation equals a 10-mile wind. Table on page 74, No. 1923.

(F) Mirage or heat waves should be treated as a wind flag and corrections made for speed and directions of the wind as shown by the moving mirage and in accordance with the windage tables.

(G) The aiming point is slightly indirect when 6 o'clock is used, being below the hitting point or center of the bull's-eye. When the battle sight is used at short distances it is still lower, hence more indirect. Higher elevation is required to offset the lower aiming point.

(H) The effect of light on sight setting is individual and each man must determine for himself by actual shooting. Care in looking at the outline of the sights and the target will reduce light effect. Heat raises the hit; cold lowers it; moisture raises it, and dryness lowers it.

(I) To set a Winchester A–5 telescopic sight, boresight the rifle for both zero elevation and windage. Add together all of the serial numbers for each 100 yards distance; the total will be the number of graduations to raise the sight for elevation up to 600 yards. Above 600 yards 50 per cent more than the serial numbers must be added. For windage move the sight from zero the same as the metallic sight, counting each graduation one-eighth of a point.

12. GALLERY PRACTICE.

(A) Regular targets.
(B) Animated targets.

13. RANGE OPERATION.

(A) Range officers and duties.
(B) Pit officers and duties.
(C) Scorers and duties.
(D) Pit detail and duties.
(E) Organization of firing details.
(F) Rotation of firing sections.
(G) Instructors for firing sections.
(H) Amount of firing.
(I) Operation order.

14. RECORDS.

(A) Notes.
(B) Scorebooks.
(C) Statistics.

15. EXTERIOR BALLISTICS.

(A) Trajectory.
(B) Range.
(C) Line of site.
(D) Line of departure.
(E) Angle of site.
(F) Angle of departure.
(G) Friction.
(H) Theory of drift.
(I) Primer, powder, bullet.
(J) Parallelogram of forces.
(K) Kinetic energy, air resistance, gravity, wind.
(L) Plotting trajectory.
(M) Temperature and density.
(N) Striking energy.

16. SAFETY CAUTIONS.

(A) Never fire before cleaning cosmic from the barrel.

(B) Never fire when the barrel is plugged with snow, mud, dirt, or other obstruction.

(C) Never fire with dust in the barrel; metal fouling results.

(D) Always clean cosmic from the bolt and main spring; it causes misfires.

(E) Always keep the bolt open on the rifle range.

(F) Never push the bolt forward with the leaf sight laid to the rear (1917 rifle).

(G) If necessary to lay rifle on the ground, have the bolt up and the muzzle clear of the ground.

(H) When assembling the bolt always screw the sleeve clear up; otherwise misfires will result. (1917 rifle.)

(I) Never put the finger on the trigger except at time of firing or in a proper drill.

(J) Always turn safety lock clear back and never squeeze the trigger when pushing the safety lock to the ready position.

(K) The bayonet must always be securely fastened to the rifle before firing with fixed bayonet.

(L) Never point a rifle at any person except in battle.

(M) Never aim or squeeze the trigger after issue of ammunition except at the target.

(N) Ball cartridges will never be mixed with dummies and never taken to quarters.

17. RANGE FIRING.

(A) Preliminary slow fire, using 10 commandments.

(B) Fire for groups at short range.

(C) As soon as good groups are fired—

(*a*) Determine normal elevations.

(*b*) Zero for windage.

(D) Begin rapid-fire practice after normals and zero are found.

(E) Also increase the distance in slow fire as fast as improvement in holding will permit.

(*a*) The test of how long a range to fire is the hit on the target.

(*b*) Is ready to fire at 1,000 yards when can stay on the target.

(*c*) There is more value in firing one shot at long range than several shots at short range if the holding is good enough to stay on the target and improve after the hits are marked.

(F) Sniping firing—

(*a*) Is improved by proper building of sniping posts.

(*b*) First build for position of man, rifle, and sandbag, whether prone, sitting, or standing.

(*c*) Adjust man, rifle, and sandbag in position, and then build port hole to fit.

(G) Record firing—

(*a*) Is a test of the training.

18. FUNCTIONING AND REPAIRS.

(A) Functioning of clip and cartridges.
(B) Of bolt.
(C) Of trigger.
(D) Primary extraction; extraction and ejection.
(E) Locking.
(F) Loading.
(G) Fixing trigger squeeze.

19. INTEREST AND ENTHUSIASM.

Recoil drills.
Buck fever.

20. DAILY CRITIQUE AND REVIEW.

(A) Solves each man's troubles for everybody.
(B) Secures uniformity.
(C) Makes the instruction impressive.

RIFLE TRAINING FOR WAR.

CHAPTER 1.

NOMENCLATURE, DISMOUNTING, AND ASSEMBLING RIFLE.

(A) It is not here intended to give the details of description as laid down in pamphlet "No. 1923—Description and Rules for the Management of the United States Rifle, Caliber .30, Model of 1903," and for a fuller description reference should be made to this pamphlet.

The bolt and magazine mechanism can be dismounted without removing the stock. The latter should never be done, except for making repairs, and then only by some selected and instructed man.

Place the cut-off at the center notch; cock the arm and turn the safety lock to a vertical position, raise the bolt handle, and draw out the bolt.

Hold bolt in left hand, press sleeve lock in with thumb of right hand to unlock sleeve from bolt, and unscrew sleeve by turning to the left.

Hold sleeve between forefinger and thumb of the left hand, draw cocking piece back with middle finger and thumb of right hand, turn safety lock down to the left with the forefinger of the right hand, in order to allow the cocking piece to move forward in sleeve, thus partially relieving the tension of mainspring; with the cocking piece against the breast, draw back the firing-pin sleeve with the forefinger and thumb of right hand and hold it in this position while removing

the striker with the left hand; remove firing-pin sleeve and mainspring; pull firing pin out of sleeve; turn the extractor to the right, forcing its tongue out of its groove in the front of the bolt, and force the extractor forward and off the bolt.

To assemble bolt mechanism.—Grasp with the left hand the rear of the bolt, handle up, and turn the extractor collar with the thumb and forefinger of the right hand until its lug is on a line with the safety lug on the bolt; take the extractor in the right hand and insert the lug on the collar in the undercuts in the extractor by pushing the extractor to the rear until its tongue comes in contact with the rim on the face of the bolt (a slight pressure with the left thumb on the top of the rear part of the extractor assists in this operation); turn the extractor to the right until it is over the right lug; take the bolt in the right hand and press the hook of the extractor against the butt plate or some rigid object until the tongue of the extractor enters its groove in the bolt.

With the safety lock turned down to the left to permit the firing pin to enter the sleeve as far as possible, assemble the sleeve and firing pin; place the cocking piece against the breast and put on mainspring, firing-pin sleeve, and striker. Hold the cocking piece between the thumb and forefinger of the left hand, and by pressing the striker point against some substance not hard enough to injure it, force the cocking piece back until the safety lock can be turned to the vertical position with the right hand; insert the firing pin in the bolt and screw up the sleeve (by turning it to the right) until the sleeve lock enters its notch on the bolt.

See that the cut-off is at the center notch; hold the piece under floor plate in the fingers of the left hand, the thumb extending over the left side of the receiver; take bolt in right hand with safety lock in a vertical position and safety lug up; press rear end of follower down with left thumb and push bolt into the receiver; lower bolt handle; turn safety lock and cut-off down to the left with right hand.

(B) *To dismount magazine mechanism.*—With the bullet end of a cartridge press the floor plate catch (through the hole in the floor plate) at the same time drawing the bullet to the rear; this releases the floor plate.

Raise the rear end of the first limb of the magazine spring high enough to clear the lug on the floor plate and draw it out of its mortise; proceed in the same manner to remove the follower.

To assemble magazine spring and follower to floor plate, reverse operation of dismounting.

Insert the follower and magazine spring in the magazine, place the tenon on the front end of the floor plate in its recess in the magazine, then place the lug on the rear end of the floor plate in its slot in the guard, and press the rear end of the floor plate forward and inward at the same time, forcing the floor plate into its seat in the guard.

(C) *To complete dismounting* (not to be done by soldier).—The bolt and magazine mechanism having been dismounted, proceed as follows:

1. Turn safety lock to dismounting bevel on sleeve and remove it by striking the thumb piece a light blow.

2. To dismount the sleeve lock, drive out sleeve lock pin from the top and remove lock and spring, being careful not to lose the spring.

3. Remove front sight pin and remove front sight.

4. Press in rear end of lower band spring and drive forward the lower band by a few sharp blows on the lug and then on top with a hardwood block.

5. Remove upper band screw and drive upper band forward, in the same manner prescribed for the lower band.

6. Move upper band forward on barrel until stopped by movable stud, and then remove lower band by slipping it over upper band and movable stud. To remove upper band entirely from barrel requires the removal of the front sight screw and movable stud.

7. Draw hand guard forward until free from the fixed base and remove.

8. Remove guard screws and guard. It may be necessary to tap gently on the front and rear of the guard bow to loosen.

9. Remove barrel and receiver from stock.

10. To remove the lower band spring, drive its spindle out of its hole in the stock from the left.

11. Unscrew the butt swivel screws and remove the butt swivel plate from stock. The butt swivel, consisting of the plate, swivel, and pin, permanently assembled, is issued complete.

12. Unscrew butt plate screws and remove butt plate from stock.

13. Unscrew butt plate spring screw and remove the butt plate spring; drive out butt plate pin and remove butt plate cap.

14. Remove cut-off by loosening the screw in the end of the thumb piece until it disengages the groove in the cut-off spindle; insert the blade of a screw driver in the notch in the rear end of the spindle and force it out. Remove the spring and the plunger, being careful not to lose them.

15. Remove the ejector by driving out the ejector pin from the upper side.

16. Remove sear and trigger by driving out the sear pin from the right, being careful not to lose the sear spring.

17. Remove trigger from sear by driving out the trigger pin from either side.

18. Remove floor plate catch and spring by driving out the pin from either side.

19. Remove bolt stop by inserting a small punch or end of striker in the hole in the left end and forcing it from its pocket.

The leaf should never be removed from the movable base except for the purpose of making repairs.

The fixed base and the fixed stud should never be removed from the barrel. The barrel should never be unscrewed from the receiver. The barrel and receiver may be assembled only at ordnance establishments properly equipped for this work, for which reason requisition should always call for barrels and receivers assembled and not for barrels alone.

To assemble after dismounting.—Reverse and follow in inverse order the operatings of dismounting.

In assembling the sleeve lock to the sleeve, be careful to compress the lock and spring while driving in the pin from the bottom of the sleeve.

To assemble the safety lock and sleeve, insert the safety lock spindle in its hole in the sleeve as far as it will go; then, with the thumb piece vertical and pressed against some rigid object, introduce the point of the tool provided for this purpose between the safety lock spindle and the safety lock plunger, forcing the latter into the thumb piece until it slips over the edge of the sleeve. Further pressure on the safety lock thumb piece, together with the gradual withdrawal of the tool, will complete the assembling.

In assembling pins and screws, note directions for replacing broken parts on page 47, "Description and rules for the management of the United States rifle, caliber .30, model of 1903."

The floor plate spring and the cut-off spring are alike, except in length. The latter being the longer, care should be taken not to substitute one for the other.

(D) In addition to the formal naming of the parts of the rifle, emphasis should be placed upon the important parts. Some of them are so important, the mechanical measurements should be learned. Some of the functions are likewise so important that they deserve special study. Among these the three things that are of the most vital concern are: The lands at the muzzle, the guard screws, and the trigger squeeze.

1. *Lands at muzzle.*—No rifle will shoot accurately unless the lands at the muzzle are right. This is the most delicate part of the whole rifle. In the manufacture the caliber on the face of the lands is determined by a minimum and maximum gauge. The minimum is 0.2999, or 0.0001 less than .30 caliber, and the maximum is 0.302, or 0.002 more than .30 caliber.

If the barrel will not take the minimum gauge, the caliber is too small, and it is rejected for that reason. If it does take the maximum gauge it is too large and is rejected for that reason. When the rifle is so worn that it will take a 0.304 gauge at the muzzle, it is ready for the worn-out test. The difference between this gauge and the minimum bore is only 0.004 of an inch—there is, 0.0001 tolerance or clearance between the gauge and the bore; but this may be disregarded because that much is required for the clearance of the gauge in all cases. Therefore, the difference in diameter of the closest made new rifle and the worn-out rifle is only 0.004 of an inch. Hence, a wear on the face of each land of one-half that amount, or 0.002, is enough to wear out the rifle. This is the maximum amount, and since rifles are made with the maximum caliber of 0.302, the difference between that and the worn-out rifle is only 0.001. Whenever the lands are worn even these delicate amounts the rifle is worn out and its accuracy is gone. In order to appreciate these measurements, consider that a human hair is about 0.0015 of an inch in diameter. These gauge figures are for the 1917 rifle, but they illustrate the 1903 rifle with equal significance.

Anyone who will study these figures will be convinced that muzzle cleaning in any form and by any method should be prohibited at all times. Even a cord will easily wear off this delicate amount from the corner of the lands at the muzzle.

2. *The guard screws.*—At first glance the guard screws would not seem to be of any more importance than any other screw or part of the rifle, but such is not the fact. The rifle barrel is made to swing upon

the guard screws. Its accuracy depends upon the guard screws being tight. If either guard screw is loose the rifle will surely be erratic in its shooting. If anything goes wrong with the shooting of the rifle, the first thing to investigate is the guard screws. If they are loose, that is the trouble, and to tighten them will cure it. In all cases they must be tight.

3. *The trigger squeeze.*—The trigger and sear function together. The first bearing of the trigger pushes the sear nose downward in the sear notch. The second bearing, which is the trigger heel, pushes the sear nose out of the sear notch and releases the striker. This double squeeze has a distinct value in rifle shooting. The first squeeze is to give command of the trigger, and the second to release the striker and discharge the piece after the sight alignment is correct. It takes more pressure for a proper final squeeze, but there should be no drags, creeps, or stops in it. The double squeeze and the mechanism that produces it deserve special attention. Every officer should learn the accurate mechanical operation necessary to make a perfect trigger squeeze. This is fully explained in the chapter on repairs.

(E) *Comparison of the service rifles.*—The service rifles are now designated as the United States rifle, Model 1903 and Model 1917.

Ammunition.—Both rifles are chambered for the same ammunition, and the initial velocity is approximately 2,700 feet per second for each rifle; perhaps about 60 feet greater for the 1917.

Weight and length.—The 1917 model weighs 9 pounds 6 ounces, as against 8.69 pounds for the 1903

model. This gives an increased weight of something over a pound, and slightly reduces the recoil.

The length of the 1917 model is 46.37 inches, and of the 1903, 43.212 inches. This extra 3 inches in length is divided between the stock and the barrel, the new model being 1 inch longer in the stock and 2 inches longer in the barrel. This slightly increased length of barrel causes a more complete burning of the powder, hence gives a greater muzzle velocity.

Sights.—It will be noticed that the 1917 has no wind-gauge correction, while the 1903 has, and this permits a greater accuracy, for the wind gauge permits the more accurate 6-o'clock hold at all times. It has been found, however, that a fair degree of accuracy can be obtained by proper instruction and practice in holding off for windage.

Battle sight.—The 1917 has a peep battle sight with an elevation of 400 yards, whereas the 1903 has an open battle sight with an elevation of about 547 yards. In other words, at 200 yards the center of impact in the 1903 model is 26 inches above the point of aim, and at 300 yards it is 28 inches, while the point of impact in the 1917 is only 14 inches at 200 yards and 10 inches at 300 yards. It is possible with a new model, shooting at the D target, to place all the hits within the 19-inch figure for elevation by aiming at the bottom of the figure on either of the ranges from 400 to 100 yards. With the 1903 model it is necessary to aim 19 inches beneath the figure at 200 yards and 21 inches at 300 yards. The figures relative to the points of impact given above are only approximate, and vary with individual rifles.

There is no argument concerning the relative accuracy of a peep and an open battle sight. Among the better class of riflemen this matter was decided in favor of the peep long ago.

Front-sight adjustment.—In the 1903 we have a variation of front sights from 0.35 inch to 0.41 inch, or 0.06 inch. There are 11 sizes of front sights in the 1917 model starting with minus 0.015 and going to plus 0.135 by 0.015-inch variation, a total of 0.15. This usually permits complete elevation correction for the 1917 model at 200 and 300 yards for the battle sight.

Zero windage.—The 1903 has no adjustment for zero windage. This zero-windage adjustment is made on the 1917 by the movement of the front sight laterally.

Sight radius.—The sight radius of the 1917 is a little over 10 inches greater; to be exact, the sight radius of the 1903 is 0.215049, the 1917, 0.3169 inch. This increased sight radius increases accuracy of aim.

The fact that the sight on the model 1917 is mounted over the receiver and is closer to the eye does away with part of the muscular strain of the eye and makes it easier to sight the rifle.

In sighting a rifle there is a continual checking of sight alignment by the focus of the eye, first on the sights and then on the target. The larger peep makes the target easier to find, and the fact that the 1917 model has the sight closer to the eye makes it easier to get the proper sight alignment..

A smaller peep on the 1917 will be more accurate in target practice and also in battle for the longer

ranges; but for the battle sight, because of the larger field and the greater opportunity of catching the target in rapid fire, it is considered better to have the larger size.

Drift.—The 1903 model has the automatic correction for part of the drift, and the 1917 has none; but it must be considered in this respect that the drift as shown by the tables, the total drift on the 1903 at 500 yards is absolutely zero, and the greatest uncorrected drift up to 500 yards, where it is zero, is 0.45 inch at 300 yards, and beyond the 500-yard range the drift at 600 yards is only 0.55 inch. The question of drift is not important at ranges below 700 yards; for it is considerably less in extent than the limits within which the best riflemen can hold.

Elevation adjustment.—The 1903 has very accurate adjustment for elevation, which is a great advantage over the 1917. The 1917 adjusts only by 100-yard notches up to 900 yards, and by 50-yard notches above that.

Conclusion.—Giving due weight to all of these facts, it is a fair conclusion to say that the 1917 battle sight is more accurate, and better suited to men both for battle and target firing, and the margin in its favor is quite substantial. It is equally true that the 1903 with its wind gauge, is more accurate elevation adjustment, and smaller peep is better suited for both target and battle firing at the longer ranges.

Bayonet efficiency.—The 1917 having the greatest length, and also the longer bayonet, it has the advantage, the bayonet of the 1903 being 20.587 inches and the bayonet of the 1917, 21.655 inches.

Bore.—The 1903 has four grooves and four lands of a depth of 0.004 inch; the 1917 has five grooves and five lands of a depth of 0.005 inch. The width of the grooves of the 1903 are 0.1767 inch and on the 1917 0.0936 inch. The width of the lands on the 1903 are 0.0589 inch, and on the 1917, 0.0936 inch. On both rifles the twist is 1 turn in 10 inches, the twist in the 1903 being to the right and in the 1917 being to the left. These differences do not very materially affect the accuracy of the two rifles. The wider lands of the 1917 may increase the life of the barrel because of the greater thickness of metal wearing against the side friction, and the greater depth of the grooves might slightly increase the dispersion.

Bolt action.—The 1903 is brought to a full cock on the raising of the bolt handle. This is done by means of a camming action of the cocking piece of the bolt. The 1917 half cocks on the raising of the bolt handle by similar camming action, and the full cock is by hand pressure compressing the mainspring on the forward movement of the bolt. The pressure exerted on the forward movement of the bolt must overcome the entire tension of the mainspring. It will thus be seen that it is harder to raise the handle of the 1903 bolt because the mainspring is compressed at that time; but it is harder to push the bolt forward on the 1917, at which time the mainspring is compressed. A running start can be had and the bolt snapped home on the 1917, but the bolt of the 1903 must be lifted by main strength. After proper training in manipulation the bolt action of the 1917 is better for rapid fire.

Triggers.—The trigger squeeze of the two rifles is substantially the same, based upon the idea of a double squeeze, caused by two separate bearings against the receiver. The first pushes the sear nose well down in the sear notch and gives the "command hold of the trigger." On the final squeeze the heel bearing pushes the sear nose out of the sear notch and releases the striker. The squeeze of the 1917 is usually heavier than the 1903, but that is no disadvantage providing the final squeeze has no drags, creeps, or stops.

Each soldier should be required to pass Tests I and II of Change 20 of the Small-Arms Firing Manual.

CHAPTER 2.

THE CARE AND CLEANING OF RIFLE.

In a climate that will permit, all firing should be done with greased bullets during the training period. It may be both undesirable and impossible to use grease in battle, but its use preserves the rifle to such an extent that it should be used in training. A range covered with blowing sand will preclude the use of grease, but there is a wax combination equally good which may be used under these conditions.

The grease or wax must be kept clean. If mixed with sand and dirt it ruins the rifle. If kept clean it will more than double the life of the rifle and reduce acid fouling and prevent metal fouling. Mobilubricant, Polarine cup grease, or Keystone journal grease

are suitable for this purpose, and can be obtained anywhere. A thin film of grease should be applied to the bullet, but none to the case. If grease is used the burned residue will protect the rifle for about one day, but the only safe way to care for it is to wipe this residue out and oil thoroughly after firing. The residue is not hard to remove when greased bullets are used. If dry bullets are used the rifle must be cleaned immediately and must also be wiped again the next day to prevent acid fouling.

The rifle is preserved by oiling after thorough cleaning. The main purpose of cleaning is to put the rifle in condition so it can be inspected and so it can be properly oiled. An excessive amount of rubbing the rifle with a cleaning patch will wear it out and ruin it. All unnecessary rubbing should be avoided. Enough should be done only to remove the residue.

The oiling is the important thing. If a rifle is inspected clean and shining, it should be oiled immediately and inspected again. The shining inspection is not sufficient. It will show the condition of the rifle, but nothing more. If the rifle is to be preserved, it must be oiled afterwards. Orders for oiling will not get rifles oiled. They must be inspected to see that the orders are carried out. In the field rifles should be inspected daily for oil. Once a week is enough to wipe them out and inspect them shining.

To clean and oil after firing:

(1) Run one tight dry patch completely through bore once.

(2) Put warm sal-soda solution (20 per cent strength) in can or pan, insert muzzle of rifle in solution, and pump up through bore by means of wiping

rod and patch. (This can be done by pull through if cleaning rods are not available). Cold soda solution can be used, but is not as good as warm. If no sal-soda is available, use hot water. Common soda is good for this purpose. This removes the powder fouling and prevents the acid reaction from the powder residue.

(3) Dry thoroughly with patches and cleaning rod, keeping the rubbing to a minimum. This rubbing is for drying only and not to bring the last patch through perfectly clean.

(4) If metal fouling adheres to the bore in visible patches, the rifle should be taken to an expert, who will remove the fouling with an ammonia solution. The ordinary soldier should not use the ammonia solution; it has ruined more rifles when so used than have been ruined by metal fouling.

(5) Oil with sperm oil or other light, nonvegetable oil when rifle is to be kept in daily firing.

(6) If rifle is to be stored 2 and 3 must be repeated the following day and then apply heavy coating of cosmoline. The cosmoline should be heated to a liquid, the bore plugged at the breech, the heated cosmoline poured in, filling the bore, and then poured out. This will leave a heavy, solid coating on all parts of the bore. Rifle should be in a moderately warm room in winter for this oiling.

(7) If rifle is in daily use but not firing, 2 and 3 must be repeated the day following last firing and then apply a coating of sperm oil which has had dissolved in it a small amount of cosmoline. This will preserve a rifle safely one week unless out in bad weather conditions, in which case it must be oiled

daily. This mixture of sperm oil and cosmoline is especially recommended and is usually available.

The practice of conserving oil and cleaning materials for future use must be condemned. They should be used now and more provided for the future. A $30 rifle is rusted and ruined when 2 cents' worth of cleaning material would preserve it. If oil and cleaning material are on hand there can be no excuse for rusted rifles, and if not on hand they should be secured at once.

Dissolve cosmoline in sperm oil and apply to all the metal parts of the rifle, and until removed it will prevent injury from a gas attack. If not oiled in this manner after a gas attack, the rifles should be washed with a soda solution, dried, and oiled.

In order to do all these things properly provide a good cleaning rack for each platoon.

CHAPTER 3.

A. POSITION DRILLS.

Position drills are the first in preliminary training. A short time should be devoted to teaching the accurate positions. The variations allowed in the Small-Arms Firing Manual to suit the conformations of the man should be encouraged. Positions should be uniform for the purpose of fitting the rifle and the man together, and not for the purpose of geometrical measurements or forms.

(*a*) The prone position is the most reliable of all shooting positions. It is the one that will always be used when the terrain will permit. In this position the general alignment of the body should be about

45 degrees from the alignment of the rifle. This permits a better use of the sling, fits the body to the rifle better, and avoids injury from recoil by an elastic rolling of the body. It may be that this position would not be assumed in battle; that the requirements of protection by cover would even keep the body in direct alignment with the rifle. But none of these things are any argument against taking the best position during the training period. The position that will teach the best hold of the rifle in the shortest time is the best to use during the training. The important thing is learning to hold the rifle. When that is learned the soldier will fire from any distorted position and still hold his rifle because he has learned how to do it and knows well the necessity. There is no other position quite equal to the prone with the sling and without the sandbag.

(*b*) Next to the prone, the sitting position is the most reliable. It is quite steady and if each man is permitted to adjust his elbows below the points of his knees in such way as to suit his conformation this position will give excellent results. It is impossible to get good results if the elbows are rested on the points of the kneecaps. Each man must find the exact point that fits his own individuality. There will not be a wide difference, but exact uniformity should not be attempted. The sling may be used in this position with the arm through the loop the same as in the prone position or the grapevine sling may be used. This position is higher and may be used in battle when the prone is impossible.

(*c*) The kneeling position is not so steady as the sitting position. This position is very much improved

when a man can turn his foot and sit on the side of it. This position is authorized and should be encouraged, but it is impossible for about 30 per cent of the men. In the kneeling position the grapevine sling is the best. This position is still higher than sitting.

(*d*) The standing position without a rest is the most difficult of all. It is easy for the manipulation of the rifle, but very unsteady. However, it must often be used in battle and especially for fire during movement. The grapevine sling is the best for this position. There are several different standing positions used by riflemen. They are the full-arm extension, the half-arm extension, the body rest, and the hip rest. In target practice in light winds the hip rest is most accurate, but it is not so desirable for battle firing. For all purposes the half-arm extension and grapevine sling makes the best combination. This is the highest position and will be used when the view is impossible from the others.

(*e*) The standing trench position has developed out of trench warfare. It is a very important position and, with the sandbag rest, is almost as reliable as the prone and much easier. In this position the sling should not be used.

B. SLING ADJUSTMENTS.

(*a*) For the prone position turn the upper loop of the sling and pass the left arm through from the right side. Then wrap the arm around the sling and grasp the stock of the rifle with the left hand at the point to suit the length of the arm. The lower loop of the sling is left loose and really has no function to per-

form. The length of the upper loop can only be determined by trial, but must be made to fit each man. This loop should be adjusted above the muscles of the upper arm and held in place by the keeper. The sling should always be adjusted in such length as to draw tight, which can only be learned by trial.

(*b*) In the sitting position the sling may be adjusted as in the prone, or the grapevine sling may be used as already noted. In the grapevine sling the hook of the lower loop is brought up into the holes of the upper loop at such a length as will permit the whole sling to be turned and then wrapped around the right arm. The sling then draws tight across the breast and holds the rifle in place on the shoulder. The arm does not go through either loop.

(*c*) In the kneeling position the grapevine sling is the best.

(*d*) In the standing position the grapevine sling is the best.

(*e*) In the standing trench position the sandbag rest without sling is the best.

C. SANDBAG ADJUSTMENTS.

(*a*) In the prone position with the sling and with the sandbag the hand should rest on the bag and the rifle on the hand. In this position the rifle should not be permitted to touch the sandbag. It is practically the same as the regular prone position with the sandbag adjusted to give support to the hand without changing its position.

(*b*) The next best prone position is without the sling and the sandbag placed under the point of explosion. This is an easy point of rest to obtain and

it is the easiest of all shooting positions. It is also very accurate and the difference if any between it and the regular prone position is very slight. This difference when it occurs is caused by resting the rifle on the sandbag at a different point. After each man has learned to shoot a good group in this position he should then be asked to take a rest on the sandbag near the muzzle of his rifle, fire a few shots, and note the difference. When the sandbag rest is used it is important that the rifle be rested at the same point for each shot, and the best point is under the chamber where the explosion occurs. This rest stops a large percentage of the recoil, and makes holding much easier. The sling is no assistance whatever, and should be loosened enough to put to one side.

(*c*) In the standing trench position the sandbag rest should be without the sling and exactly the same as last described for the prone position. The sandbag should be so adjusted that there will be shelf room for the resting of the elbows. If these things are observed the results of this position will be just as good as the prone position with the sandbag and without the sling.

(*d*) In addition to these positions from parapet, wall top, vertical edge of wall, door, window, tree or such other positions as required by Test No. 8, Charge No. 20, Small Arms Firing Manual should be taught.

D. PUSH AND PULL DRILL.

The push and pull drill is some aid in learning these different positions, but its main value is as a setting-up exercise and no great amount of time should be devoted to it as a firing drill.

CHAPTER 4.

MANIPULATION DRILLS.

In the preceding chapter position drills have been taken up. We now come to a manipulation drill, and hereafter we will treat of an aiming drill. Tell the recruit that aiming is too important to attempt at the very start. Tell him you will have something to say later about real aiming, and the first problem is training the muscles to operate the rifle. He will take the positions of aiming, but in the manipulation drill this is only a simulation. See that he so understands it. See that you so understand it yourself.

Start with the sling and the standing position. Use all the positions, but prone most. Keep the rifle on the shoulder as the bolt is worked in all the positions. Start slowly and increase the speed gradually. This should continue until the reflexes perform the whole operation and leave the mind free to think about the aiming.

The watchword of manipulation is work. The object is speed. In this connection it might be stated that the watchword of aiming is care. The care required will be taken up in the succeeding chapters, but at this point it might be well to state that the degree of care is as much as if your rifle were loaded and your life depended upon hitting. Therefore you do not—

Put up targets promiscuously and casually aim at them in passing and call it a sighting and aiming drill. You may do that kind of *manipulation* drill but do not call it aiming.

Manipulation drills are prescribed for a distinct purpose. They are to train the muscles and the nerve centers in the operation of the rifle. During these

drills, soldiers should be made to distinctly understand that they are not aiming drills and that he only simulates aiming by taking the position. The lifting of the bolt handle is the hard part of manipulating the 1903 rifle.

These drills should be conducted in all the positions both with and without the sling. The proficiency test should be made in the prone position and with the sling, because it is hardest to learn. These drills should be conducted first with the trigger tied back. The purpose is to secure rapid manipulation of the bolt. This drill does not meet all the requirements in bolt manipulation because the trigger is not squeezed. However, as this practice is for the purpose of attaining the highest speed it will be found that a trigger squeeze will degenerate into a mere jerk if made a part of the drill. It is, therefore, best to attain this high speed with the trigger squeeze omitted and thus avoid the development of a bad habit in squeezing the trigger.

These drills should be:

1. Standing.
2. Kneeling.
3. Sitting.
4. Prone.

The positions should be taken by the regular commands of the Infantry Drill Regulations but with the latitude allowed in the firing manual, and the manipulation should be conducted by the following commands:

1. ——— times manipulation. 2. Exercise. The soldier being in position manipulates the bolt as rapidly as possible the number of times designated. Five times are enough for the start.

1. At will. Manipulation. 2. Exercise. 3. Halt. The soldier being in position manipulates the bolt as rapidly as possible until the command halt and without squeezing the trigger. In the beginning this will be done slowly and the speed increased as the muscular control increases.

1. Twenty times, Manipulation. 2. Exercise. The soldier manipulates the bolt as rapidly as possible the required number of times. The same caution is observed as to beginning.

These exercises should be repeated until the manipulation of the bolt in this manner becomes easy and until the soldier has attained the speed of 20 times in 15 seconds in the prone position and in the sling.

CHAPTER 5.

(A) SIGHT ALIGNMENT.

The question of aiming will be further discussed in parts 7 and 8. The comparison of the sights on the Model 1903 and 1917 has been fully considered in No. 1. It is only intended here to take up the proper method of sight alignment.

The open sight.—The normal sight alignment is shown by Fig. 1, Plate III., page 30, S. A. F. M. The front sight is centered laterally in the notch of the rear sight, and the top is level with the top of the notch. It will also be noticed that the aiming point is at 6 o'clock below the bull's-eye and on the white. The reason for this is that the eye can see a black sight better on a white background. If the front sight is permitted to touch the bull's-eye, it is impossible to

tell at what part it will be aiming and accuracy of aiming point is lost. The line of white should be the same for each shot. It should be wide enough to see the bottom edge of the bull sharp and distinct. There is no advantage in crowding close to the bull. It tends to blur, strains the eye, and reduces accuracy with many men in some lights. At 1,000 yards the white line must be about 6 inches wide to be seen. There is only 18 inches of white below the bull's-eye, and when the sight appears upon the white it will be 6 inches below the bull and 6 inches above the bottom at least. This only leaves 6 inches to wander over, and that is closer than any man can hold. Therefore the best method at this distance is simply to make sure that you are on the white at 6 o'clock.

The peep sight.—Fig. 2 of the same plate shows the normal peep sight alignment. The top of the front sight is brought to the center of the peep and there is the same rule with reference to aiming point on the white.

OTHER METHODS OF AIMING.

The Navy method of aiming is described in section 88 in the Navy Small-Arms Firing Regulations, as follows:

"In aiming the eye should be held as close as possible to the peep; that is, almost up to the comb of the firing pin. Then aim so that the bull's-eye is exactly in the center of the peephole and the top of the front sight in the center of the bull's-eye."

In an ordinary light and upon a bull's-eye target this method of aiming is perhaps as accurate as the 6 o'clock hold of the Small-Arms Firing Manual. It will be found, however, that the top of the front sight

is held at the center of the bull's-eye rather by keeping it in the center of the peep than by actually seeing it at the aiming point or center of the bull's-eye. With a black sight and a black bull's-eye and especially at long ranges it is impossible to distinguish at what part of the bull's-eye the top of the front sight is pointing. But if the top of the front sight is at the center of the peep and the bull's-eye then also brought to the center of the peep as a matter of course, the top of the front sight will be pointing at the center of the bull's-eye without regard to whether the eye sees the center or not. As it is easy to center a round bull's-eye in the peep, this method of aiming at targets is quite satisfactory. If the target is a moving object or figure of a man, the centering in the peep is much more difficult if not impossible. Also with the battle sight, the principle of the aiming point must be followed. In battle fire the top of the front sight will also be aligned on some aiming point. For these reasons the Small-Arms Firing Manual selects the aiming point at 6 o'clock on the white, where it can best be seen, and then directs that the top of the front sight be aligned with it. The Navy method aligns the top of the front sight with the point where the hit is desired. This is the correct idea for battle fire, but in target shooting the alignment is theoretical rather than actually seen. The Army method actually sees the aiming point, but it is indirect, being below the hitting point. With the battle sight at short ranges this is necessary in all kinds of fire. Therefore, the Army training is uniform for both sights, and as the tendency in battle is to shoot high the training should be to aim low. This does not apply to well-trained riflemen. They

set their sights and shoot to hit. If the aiming point is low, they take more elevation. They learn how to set sights for an indirect aiming point when necessary.

(B) THE EYES AND RIFLE SHOOTING.

The human element is the greatest element in rifle training and the vision is perhaps the greatest element in the human. It is also the least understood. Rifles are made, zeroed and issued without any adjustment for individual eyes. Rules for light and mirage are made and published as if the eyes of men could not vary. In fact, the eyes of men have an individuality almost as universal as individuals themselves. They may stand the same oculist tests and still see the sights differently. The reason is, the eyes must be operated by that wonderful and unfathomable thing, the human mind. Therefore—

The question of zero windage is always an individual question.

The question of normal elevations is always an individual question.

Each man must find his zero and normals for himself.

The instructor might find them and he might not. He has no business to try.

It is his business to teach the recruit how to find them for himself.

This can only be done by actual shooting.

The effect of light is likewise individual and must be determined by actual shooting and careful records.

It is all right to read what the books say, but then go out and find if it is true for the individual in question.

No amount of training can remove the individuality and differences in eyes.

On December 7, 1917, the following experiment was conducted at the Winchester plant. Four 1917 rifles were taken from stock to the 200-yard indoor range. Two experts were selected to do the shooting. Both had been shooting on this same range for more than 10 years. Both were perhaps as expert as human beings can become. The problem was to find the distance of impact above the point of aim with the battle sight at 200 yards.

Both men sat in the same testing chair. Both fired the same ammunition. Both sighted the rifles the same. Both had the same light. Both used the same elbow rest on a testing table. Both fired the same rifles. Both fired 10 shots with each rifle. Here is the result:

Average distance of hits above aiming point, in inches.

FIRST MAN.

First rifle	19 1/16
Second rifle	15 1/8
Third rifle	21
Fourth rifle	4 1/2
Average	14 15/16

SECOND MAN.

First rifle	12
Second rifle	10 3/4
Third rifle	12 3/4
Fourth rifle	—3
Average	8 1/8

Disregarding an inconsequential fraction, one of these men hit an average of 14⅛ inches above his aiming point and the other only 8⅛ inches. It was also observed that the group of the first man was about 4 inches to the left of the second man, but this was estimated and not measured. It is, therefore, certain that these two experts could not look through the sights of the rifle the same even at the short distance of 200 yards. One of them actually sighted these rifles an average of 6⅛ inches higher and about 4 inches farther to the left than the other. Both groups were excellent. There was no difference in the expertness of the two men.

The difference was in the eyes. The eyes of both were very accurate, but different. More than 10 years of training had not removed this difference. The difference in eyes can not be removed. Each man must sight his rifle with his own eyes. Each man must learn his elevations at each distance with his own eyes.

Each man must learn his zero windage with his own eyes.

A rifle zeroed at the factory may be all right for the man who did it.

It may be a half a point off either right or left for the man who shoots it.

The 1917 rifle has a sight adjustment for zero in the front sight. The 1903 has none.

If the shooter's eyes find a 1903 rifle off for zero, he must remember how much and correct for wind accordingly.

He can correct his zero on the 1917 by moving the front sight; but, having no wind gauge, he must hold for wind.

The proper place for zero adjustment is at the rear sight and it is hoped soon to have such an adjustment on both rifles. In this connection it must also be remembered that the same man may get a different elevation and also a different zero in slow and rapid fire. Experts fight hard to keep the elevations the same in both kinds of fire, but do not always succeed. Perhaps the reason is that the same amount of care is impossible in rapid fire because of the greater speed, but these differences do occur in the same man.

Even a telescope sight will not always reconcile the differences between the eyes of individuals. Each man must find his own elevations with telescope sights.

A few eye drills are a good thing. Drills can be invented for everything, even the eyes. For instance, nearly every man is either right-eyed or left-eyed. A simple experiment will tell. Have him hold his finger 15 or 20 inches from his eyes. Sight over the end of it with both eyes open at some small object 15 or 20 feet away. Continue this sighting until both eyes see the object over the end of the finger. Shut first one eye and then the other eye. One of them will hold the finger in a straight line with the object. The other will let the finger move to one side. If the eye holds the straight line he is left-eyed. In other words, the left eye dominates. In a test of about 4,000 men about 20 per cent were found to be left-eyed.

Should a left-eyed man shoot left-handed? If the right eye is much weaker, yes. If the right eye is only slightly weaker, no. Exercise and use of the right eye may change and make him right-eyed. It is a great handicap to manipulate the rifle left-handed.

Here is a focus drill. Align the finger again with some object 5 or 6 feet distant, and with either one or both eyes focus on the finger. The finger will appear clear and distinct, but the object in line with it will appear hazy as long as the focus is on the finger, although only a few feet distant. Change the focus to the object and it will appear clear and distinct and the finger will become hazy. Jump the focus from one to the other and learn what focusing the eye means.

Here is a centering peep drill. Look through the peep above the sky line with the eye 4 or 5 inches from the peep. Study the light in the peep, and you will find it has a bright center. Some say that the eye automatically centers the peep. It certainly does like the bright center best, and has a natural tendency to find it. However, the bright center gradually disappears as the eye is brought closer to the peep, and is hardly noticeable when very close. It is also affected by shadows, and after all the center of the peep is accurately found only by looking for it carefully.

The light rules are usually stated as follows:

Light has no effect on the bullet, but does affect the eye.

The effect is the opposite for open and peep sights.

With the peep, a bright light makes the target more distinct and the hold is closer to the bull's-eye—hence the hit is higher.

The opposite is true of a dull day.

But these rules do not apply to all eyes. Some eyes see a target much more distinctly on a dull day, and the rules are reversed.

On a bright day with the open sight the rule still is to see the target more distinctly, and the tendency, therefore, is to hold higher; but in spite of this, the hit is lower with the open sight than on a dull day. Why this apparent contradiction? The lower hold is more than offset by another element. The other element is the front sight. It is not seen so distinctly on the dull day, hence it is raised higher. It looks the same to the eye, but the dull light actually causes it to stand up higher to produce the same effect on the eye. It is enough higher to overcome the lower hold on the target, and the hit is actually higher on the dull day with the open sight.

Again the rule is upset by many eyes which see everything—even sight, target, and all—more distinctly on the dull day. Every man must study his own eyes and find out whether he sees things better in a bright or dull light and how his hits are effected.

The change of light is likely to cause a greater error with the open than with the peep sight.

The direction of the light and shadow also affects the seeing. If the light is on the right side of the front sight and the eye sees this side better than the shaded side, the tendency will be to hold the right side directly under the bull's-eye, and that will give a hit to the left.

But again, some eyes might see the shaded side of the front sight more distinctly and get the opposite result.

Also a little care in noticing both sides of the front sight might avoid the error altogether.

Shadows on the sights have caused many errors in finding the windage zero. In the forenoon the zero

would be found a half of a point right and in the afternoon as much to the left. In fact, there was no change at all. In the morning the sun was on the right side of the sight and in the afternoon it was on the left. The shooter followed the tendency to use the bright side of his sight only. In the morning he put the right side of his front sight at 6 o'clock under the bull's-eye and in the afternoon he put the left side of the front sight in the same place. This shifted his zero about equal to the width of the front sight.

A knowledge of these facts and a little drill may correct the errors.

Try an aiming drill. Point the right side of the front sight at 6 o'clock. Then point the left side at the same place. Note the difference in the position of the whole sight with reference to the bull's-eye. This can be done even if the sun is on one side and the other shaded. Some eyes will actually see the shaded side better, but almost any eye can see both sides if the attempt is made to do so.

The same kind of a drill, sighting from the center and sides of a peep, will also master the effect of shadows in the peep.

These are little things to do, but the doing of little things well is what wins championships.

OTHER CAUSES OF INDIVIDUALITY.

Some claim that differences in eyes are not the causes of individual difference. A different pressure on the rifle in the hold, a different rest, a different pressure in freezing the face to the stock, and a different trigger squeeze may get different hits even if

the sight alignments were the same. All of these things are true but they do not disprove the differences in human eyes, or rather the differences in mental pictures made by human eyes, which also get different hits.

A careful test of experts in sighting triangles shows that they will not place the triangles at the same point even at 100-yard distances. Variations in the placing of the triangles of $1\frac{1}{2}$ inches were found at 100 yards with the small peep sight of the 1903 rifle and a variation of several inches was found with the larger peep sight of the 1917 rifle. In these sighting tests all of the elements were removed except the element of the eyes, and the most expert eyes did not "look the sights" the same. They made small triangles in each instance but placed them with enough variations to miss the target entirely at 1,000 yards. It is easy to make a sighting triangle test of these conclusions. Place a rifle in a rest and let three men sight triangles on the same paper at 100 yards without moving the rifle or the paper. Their triangles may be very small and accurate, but still several inches apart. A few men will place them nearly the same, but it will not take many tests to find men who place them differently. They will point the rifle with just the same difference when firing.

If spectacles are used care must be taken that they are adjusted at the same relative angle to the eye. If they are removed and not replaced in exactly the same position a change in placing the triangle may result, and there would be a like change in the hits in shooting.

SHOOTING WITH BOTH EYES OPEN.

Shooting with both eyes open is one of the new ways often suggested, as a royal road to championship.

It has some advantages for the man who has carefully learned it.

It has some perplexing disadvantages to the beginner. Therefore—

Don't try new ways on the recruit.

Don't puzzle him with the refinements.

Don't exceed the ten commandments.

However—

After he has learned to hold,

After he has learned the positions,

After he has learned the sling adjustment,

After he has learned the stock freezing,

After he has learned the trigger squeeze,

After he has learned the sight alinements,

After he has learned to call his shot,

After he has had enough practice to "settle" into his rifle—

Then you can teach him to shoot with both eyes open if you have the time.

It may confuse him at first.

It will help a little if he learns it.

Alone, it will not make a good shot out of a poor shot.

Alone, it will not make a champion out of a good shot.

Alone, no single refinement will produce these results.

The champion takes great care to learn everything that will help.

The champion, with persistent work, learns to use everything that will help.

Any man who learns to shoot well, invites care, persistence, and work, and then more care, more persistence, and more work.

The first advantage of shooting with both eyes open is a certain relief from eyestrain.

The second advantage is a little help in finding the target.

The shooting is really done by the eye that looks through the sights.

When one eye is closed the pupil expands as every eye expands in the dark. When it is opened there is a difference in the two eyes and the readjustment causes a certain strain. If both eyes are kept open all the time this strain is avoided. Anything that will avoid eyestrain is valuable.

The best way to teach the use of both eyes is to start with an ordinary telescope. After a man can look through the telescope with one eye and keep the other eye open at the same time without confusion of vision, he is ready to do the same thing through the sights of his rifle. A little practice will make it easy for him and he then gains all the advantages of using both eyes open in shooting.

(C) SIGHTING DEVICES.

a. Sighting bar.

This device is used to give the soldier a correct idea of sight alignment. As soon as he has learned from it the correct centering of the top of the front sight in the peep, and alignment of the two sights with the aiming point, this device has no further use.

b. Aiming devices.

The Belgian aiming device and the Ordnance aiming device are devices to assist the instructor in detecting errors in sight alignment. They do assist in this when the error is great and the recruit has no correct idea of the sight alignment. But they should never be used for correction in accuracy. In a general way they will disclose the error of the recruit when he is not properly centering the peep. Because of the wide difference in eyes, however, the best experts do not center the front sight in the peep in the same way and can not be trained to do so. Their mental picture is different. These devices should not be used as a test for accuracy. With the majority of men proper sight alignment can be made without their use, but sometimes they detect an error and in such cases are quite valuable.

(D) SIGHTING TRIANGLES.

1. Sighting triangles is a very valuable preliminary drill in aiming. They should be sighted at a distance of at least 100 yards and the practice should be continued until the triangle will be covered by a 25-cent piece.

2. In sighting triangles a movable bull's-eye should be placed so the front sight is at 6 o'clock, but after the required accuracy has been attained with this aiming point triangles should be sighted "holding off." Let the recruit take an aiming point 12 inches to the right or to the left of the 6 o'clock aiming point and attempt to sight his triangles from this new aiming point. It will be found much more difficult, and it will illustrate plainly his greater error in aiming when he must hold off for wind. The practice should be continued until the triangles so made approximate

those made with the 6 o'clock aiming point. This applies to the 1917 rifle.

3. By following the direction of the Small Arms Firing Manual in sighting triangles in a bright light, then with the target shaded, then with the rifle shaded, then with both shaded, and keeping a careful record of the results, each recruit can acquire valuable knowledge as to the effect of light upon his aiming. He should also sight triangles in the forenoon when the light is on the right side of the sight, and then leaving the paper in place, and the rifle in its rest, again sight them in the afternoon upon the same paper with the light on the left side of the sight. This situation assumes the sighting direction to the north, and there is no better sighting drill. It will be found that many men see the bright side of the sight more clearly and place that side upon the aiming point. If this is done in the forenoon the right side of the sight will point at the center of the aiming point. If the same thing is done in the afternoon, the left side of the sight will be pointed at the same aiming point center. This makes a variation of the full width of the front sight and is the cause of many so-called changing zeros. In fact, the zeros have not changed, it is only the different way of looking at the sight because of the different light upon it. It is the best possible drill, to teach men to look at both sides of their sight and to place the aiming point center between them. These light drills in sighting triangles will also develop the difference in eyes. Some will place the triangles lower in a bright light; others will place them higher, and with still others there will be no material difference. Whatever the result, each man can learn by these methods the effect

of light upon his own eyes, and that is the important thing. It must be noted in this connection that, if the triangles are placed higher in a dark light, then the hits will be lower in a dark light, and of course the opposite is true if the triangles are placed lower.

4. One other experiment should be conducted in sighting triangles. Several of the best men who have sighted the smallest triangles should be selected for this purpose. The more expert riflemen they may be, the better the illustration. Place a sheet of paper for the triangle target and rest the rifle with the sights aligned upon it and firmly fixed in place, Without moving either the paper or rifle, let the first man sight two triangles very carefully. If he is expert and sights carefully, the two triangles will be interwoven together. In other words they will be placed near the same spot. Let the next man do the same thing upon the same paper and with the same rifle and without either paper or rifle being moved. Sometimes his triangles will be interwoven with the first and sometimes his eyes may be so different that they will be around a point several inches away even at 100 yards distance. His triangles may be just as small and just as accurate as the first man but he will look through the sights differently and get a different result. With the 1917 rifle tests have shown a difference of 5½ inches in elevation and 3½ inches in lateral deflection at 100 yards, and by the most expert riflemen. After several men have sighted triangles on the same paper in this way, select the one who placed his triangles lowest, the one who placed his triangles highest, and the one who placed his triangles farthest either to the right or to the left of either one, or

both of these two. Get another piece of paper and have these three men sight triangles upon it again and it will be found that they constantly maintain the same relative difference in the same light. A change of light might remove or modify their differences. It is this sighting exercise which proves beyond question that each man must find the normal elevation and the zero windage of his own rifle. There can be no success in rifle training without a knowledge of this fact. It will be impossible to do all of these things with large numbers of troops, but they are a necessary part of the training of all instructors if error is to be avoided.

(E) SIGHT ADJUSTMENTS.

A careful study of the mechanical sight adjustment should be made. Commands should be given for sight setting at all ranges, also for windage. Sights should be set by the soldier and inspected by the instructor. After the zero of the rifle is determined, this should be repeated, using the corrected zero.

The first thing a rifleman wants to do is to "sight in" his rifle. In other words he wants to find its "normal elevations" and "zero windage." Most rifles will not shoot as the sights read, and if they did at 6 o'clock in the morning they would not at 1 o'clock in the afternoon. The usual change in the temperature will change all elevations. A warm air is lighter. It resists a bullet less. The bullet goes faster, does not have so long a time for falling, and therefore hits higher. At 1,000 yards, if the air becomes 30° warmer, the bullet will hit 40 inches higher, which is almost equal to 40 yards raise in the elevation on the sight.

Likewise, if the sights were made correct for one man, they might be incorrect for the next man who "looks the sights" differently.

Give an untrained platoon the command: Range 500.

Look at their sights and they will all be adjusted at the graduation for 500 yards.

Shoot the rifles and they will hit all the way from 400 yards to 600 yards.

Give the same command to a well-trained platoon of riflemen: Range 500.

Look at their sights and you will find them set all the way from 400 yards to 600 yards.

Shoot the rifles and they will all hit at 500 yards.

This result assumes that both platoons held the rifles correctly.

In fact, the untrained platoon would not hold good, and its scatteration would be much greater.

Each man in the trained platoon had learned his normal elevations and had set his sight as his particular rifle shoots for his eyes at the required distance.

Again, with the 1903 rifle, give the untrained platoon the command: Wind two points right.

Look at the sights and each wind gauge will be set at two points right.

Shoot the rifles and the hits will disperse right and left 30 inches more than the errors of ammunition, rifles and man.

Give the same command to the trained platoon: Wind two points right.

Look at the sights and they will be set for windage all the way from 1¼ points right to 2¾ points right.

Shoot the rifles and there will be no right and left dispersion, except the errors of ammunition, rifles, and men.

The extreme variation for elevation, of even the best made rifles, is more than 200 yards.

The extreme variation for windage is about three-quarters of a point each way or a total of 1½ points.

A point of windage is equal to 4 inches on the target for each 100 yards distance from the target. Therefore, the lateral errors caused by incorrect zeroes at 500 yards will amount to 30 inches.

The trained rifleman knows how to find this error and correct for it.

The untrained man shoots and misses.

The errors of zero in the 1917 rifle can be corrected in the rifle itself by a lateral adjustment of the front sight. This is an improvement over any other rifle that we have ever had. However, this adjustment can only be made by trial shooting. If the zero is wrong, the sight is moved. Nobody can tell if it has been moved the proper distance except by shooting again. If the adjustment were in the rear sight it could be set as soon as the zero is found. Therefore the correct place for the zero adjustment is with the rear sight. Such sights are now proposed and likely to be adopted for both rifles.

There is no wind gauge on the 1917 rifle, but the question of zero is just as important.

The trained rifleman would first adjust his sights for zero.

For one point at 500 yards he would then hold 20 inches right or left as the case might demand.

The untrained man would also hold 20 inches, but, not knowing his zero, this might be 15 inches too much or 15 inches too little. In either case he would miss.

How do you find normal elevations and zero windage?

It is a constant problem of rifle training.

It is an important problem of rifle training.

Select a day when the temperature is about the average of what you expect it to be during the shooting period.

Select a still time or what is called zero conditions.

Shoot the rifle at each distance and correct for elevation and windage until the group is around the center of the bull's-eye.

Make a record of the final elevation, sight reading at each distance or of the micrometer reading, and the results are the normal elevations.

Also make a record of the windage as it settled down and finally stood through the shooting and that is the zero.

The zero should be practically the same at all distances up to 600 yards. It might vary slightly beyond that.

Make a record of temperature and all weather conditions.

These results are of no value unless all of the shots were fired with a good hold.

As soon as a man can hold good he is ready to shoot for elevations and zero.

Having begun to shoot for them he never quits.

All his shooting is a constant checking with elevations and zero.

He is so much above or below normal elevations for weather conditions. He is so much right or left of zero for wind. His elevations have changed because of the wearing of the rifle. He is watching carefully to see if his zero has changed also. He is now beginning to talk the language of a real rifleman.

CHAPTER 6.

TRIGGER SQUEEZE.

Trigger squeeze is a *squeeze*,—not a pull or jerk. It is simple but important.

Too much emphasis can not be placed on the importance of trigger-squeeze instruction, and it should be given the recruit separate from the manipulation drills to prevent the probability of his acquiring an incorrect habit.

Trigger-squeeze practice should not be combined with manipulation drills until the instructor feels certain that the recruit understands and executes the trigger squeeze properly.

It is unquestionably one of the basic points that must be observed, for without it the other important points to be learned in connection with successful shooting will do little good. It can be considered as the foundation, or one of the things to be mastered first for it will be necessary before a marksman can get the full benefit of the other points of his training.

"Taking command of the trigger" is not considered a part of the "trigger squeeze." It merely means ap-

plying enough pressure to squeeze the trigger back until its heel comes in contact with the receiver.

Following this the pressure is applied *gradually*, not necessarily so *very slowly*, but it must be slow enough to be a *steady squeeze* and applied so gradually that the firer will not know when the sear will be released.

A steady squeeze such as just described can be applied with ample speed for rapid fire and should always be used in such fire.

If the firer does not put his mind on the trigger squeeze he is sure to know when the explosion is going to occur and there will be an involuntary and uncontrollable tendency toward a flinch, that is a muscular movement to counteract or possibly to avoid the recoil of the rifle.

All such movement is eliminated when the mind sees that the trigger is *properly squeezed*, and to get the best results in marksmanship every movement must be eliminated during aiming, that it is possible to eliminate.

To attain this same end it must be constantly borne in mind that the pressure must be put on the trigger with the least possible muscular movement. Do not increase the tension on the other fingers or any muscle while squeezing the trigger. Do the squeezing with only one finger. The index finger is preferable because it is the most sensitive and is much the handiest in position and in bolt manipulation, but some successful riflemen use the second finger. The choice of the first or second joint of the finger for squeezing the trigger is entirely an individual problem with each rifleman. It depends prin-

cipally on the length of his fingers and partially upon the position of his right hand.

When squeezing the trigger correctly the firer will not know exactly when the explosion is going to occur, and when he has reached that stage he will be cured of one very serious trouble, and that is flinching, for if he does not know when the rifle or pistol is going off he will not know when to flinch.

The squeeze should be stopped when *anything* causes the firer to *doubt* the correctness of his hold, such as blurring of the vision, fatigue, changing wind or light.

First be sure that everything is as you want it to be, then be *absolutely sure* to *squeeze* the *trigger* carefully.

CHAPTER 7.

TEN COMMANDMENTS.

1. Aiming drills are just as important as shooting to hit. Any aiming drill that is not conducted with the same care as shooting to hit is an improper drill. The slightest carelessness in an aiming drill tends to develop bad habits of carelessness in shooting. Such a drill is a positive injury. Every part of an aiming drill is important, but the two vital things are sight alignment and trigger squeeze. It was because of this vital importance that they were eliminated from the first manipulation drills. The aiming drill includes the manipulation drill, but adds to it all the other things that must be done in accurate shooting. The aiming drills should be conducted in all the positions,

but should begin in the prone and with the sling. Every aiming drill should be conducted with the "Ten Commandments of the Firing Point":

1. Position 45°.
2. Adjust sling high.
3. Hard on shoulder.
4. Freeze face to stock.
5. Hold breath.
6. Take command trigger.
7. Align sights.
8. Last focus on bull.
9. Final squeeze.
10. Call shot.

These catch words should be printed on paper and pasted on a small piece of cloth and pinned to the sleeve for easy reference by both the recruit and his instructor. They should also be used as commands and executed as commands until the recruit has become familiar with every element of the aiming drill. For that reason an analysis of each commandment is desired.

1. The position—45° means that the alignment of the body is 45° away from the alignment of the rifle. It may be true that this position will not be used in battle and especially in the trenches, but that is no reason against it during the training period, providing it is the best position in which to learn the rifle. It is the best position for many reasons. This angle gives the body an elastic and rolling motion from the recoil of the rifle and, therefore, prevents injury. The rifle and the sling fit more naturally into the man in this position. It gives the firmest and most vital hold. Therefore it should be used until

the rifle is learned. After that there is no objection to firing in any sort of position which the use of cover and the urgency of battle may demand.

2. Adjusting the sling high consists in moving the loop above the muscles of the upper arm and holding it there with the keeper. The value of the sling is greatly reduced if allowed to slip down below the muscles of the upper arm. At this command the recruit should reach across with his right hand and push the sling above the muscles of the upper arm and tighten it with the keeper. In a drill he should feel the sling each time to verify this position even if it is already correctly adjusted.

3. When the butt of the stock is placed on the right shoulder it should rest hard against the shoulder. This is readily accomplished by the proper adjustment of the sling. If the sling is adjusted the right length and then moved above the muscles of the upper arm, the butt will always come hard against the right shoulder. It will also stay in place. If the sling is permitted to slip down near the elbow it will no longer hold the butt hard against the shoulder and it also permits the muzzle of the rifle to drop toward the ground.

4. The face must in all cases be frozen to the stock. To omit this is to fail in good holding. The face should be frozen in such a position that the eye will see the top of the front sight in the center of the peep. This position gives the proper alignment of the sights with the eye and there is nothing left to do but to move the whole combination of sights and eye together to complete the sight alignment upon the proper aiming point.

5. The breath must be held at the time of sight alignment and until the final squeeze of the trigger. It is impossible to do accurate shooting unless this is done. The proper method is to take a long breath, exhale part until the feeling is easy and then hold the breath until after the final squeeze. It should be done habitually on the first trial.

6. The double squeeze of the trigger is for the purpose of giving the command hold. This command is taken by squeezing the trigger back until the stop occasioned by the heel bearing engaging the receiver is felt. The trigger is held in this position until the sight alignment is complete. Squeezing the trigger back and holding in this position is taking command of it.

7. We have already mentioned a part of the sight alignment when the face is frozen to the stock. By the seventh commandment this alignment is completed by putting the top of the front sight on the aiming point which is normally at 6 o'clock under the bull's-eye with a distinct white line.

(*a*) First find the center of the peep. The center is clearly marked and can be found in the following manner: Notice whether all parts of the rim of the peep are sharp and clearly defined. If the upper part of the peep is sharp and the lower is woolly, the positon of the eye is too high, and this applies to the same condition at the sides of the peep. When all of the parts of the rim are clear, the eye is in the proper alignment, but still may not be at the correct distance from the peep. By moving the eye forward or backward it will be seen that the appearance of the light within the circle changes. There

is a dark border close to the edge of the peep inclosing a brighter center, and when the eye sees this distinctly it is in the proper position.

NOTE.—In the center of this brighter portion a second reversal of the rays of light takes place. In other words, there is another dark band with a very bright center. This is the exact optical center of the peep, but is usually not visible when the front sight larger bright center. The 1903 sight is so far from the eye that the bright optical center is not seen.

(*b*) Next pass the focus forward from the peep to the front sight. If the top of the front sight is clear and sharp, it is in the center of the peep, but if it is the least bit indistinct, it should be moved up or down, or from one side to the other until it clears up. When it is sharp the two points, namely, the center of the peep and the top of the front sight, are in alignment.

(*c*) Next transfer the focus of the eye to the point of contact between the top of the front sight and the bull's-eye. The lower edge of the bull's-eye becomes sharp in its turn when the other two points become relatively less clear, because of the impossibility of focusing the eye upon more than one point at a time. In this position the seventh commandment is fulfilled. The sights are aligned.

8. In aligning the sights the eye will not focus on both sights and the bull's-eye at one time because each is a different distance from the eye. The eye will only focus on one distance at one time; therefore, the sight alignment is made by jumping or changing the focus of the eye from the center of the rear sight to the top of the front sight, and thence to the aiming

point at 6 o'clock under the bull's-eye. The last focus is on the aiming point at the bull's-eye. It is also true that when this last focus is first made and finds the bull's-eye in the proper place, or finds the sights in the proper alignment with the bull's-eye, then is the time for the final squeeze. The first time this last focus is found to be correct is the best time for the final squeeze. The eye is strained less than at any other time and it will see better.

9. After all of the other eight commandments have been kept and the last focus in the sight alignment upon the bull's-eye indicates the sight alignment to be correct, then is the time for the final squeeze. This is the most critical moment in rifle training. This final squeeze should be directed by the mind promptly and steadily and without any movement of the rifle or any attention to the explosion. The whole business of the mind at this critical moment is to note the sight alignment and direct the prompt and steady squeeze.

10. If the mental attention was upon the sight alignment and if the final squeeze was steady and without movement of the piece, then the firer is able to call his shot or hold. If the sights were correctly aligned with the aiming point at the time of squeeze, he should call his hold good. If the front sight rose higher than his aiming point, he should call it high. If the front sight moved to the right of his aiming point at the time of final squeeze, he should call it to the right. Practice in this will enable him in a little while to call his shots quite accurately, and this should always be done in the aiming drills and in shooting. To neglect calling the shot or hold, is to neglect the best guide for improvement in rifle firing.

CHAPTER 8.

AIMING DRILLS.

The "ten commandments" are a complete analysis of everything to do in a slow-fire aiming drill in the prone position and in the sling. This should be the first aiming drill. Targets should be provided for the purpose and the ten commandments used as commands. This insures great care in the drill and all aiming drills are useless unless great care is used. They are worse than useless when carelessly done because they develop a bad habit that must be overcome later. The care of the aiming drill must be of the same degree as the care of shooting to hit.

After the aiming drill in the prone position there should be slow-fire aiming drills in all the positions conducted in the same manner and with the same care. Only slight modification of the commands is necessary. For instance, the first can be reduced to the word "Position." The second can be reduced to the words "Adjust sling." The others will apply to any position. For assuming the positions the commands of the infantry drill regulations may be used and then follow with the ten commandments. There is no other preliminary instruction in aiming quite so reliable as this.

CHAPTER 9.

RAPID LOADING.

There is not much to be said under this subject. If it were not for the fact that rapid loading is nearly always neglected in the preliminary training, it would

not be made a separate subject. Since it is neglected and is very important in rapid-fire training special attention must be called to it. Rapid loading should be learned by practice with dummies. The dummies load harder than the regular cartridges. If the recruit will practice loading with dummies until he can load them easily and quickly he has mastered rapid loading. He is not ready for rapid-fire aiming drills until this is done.

In this same connection note the chapter on functioning.

Rapid loading should be practiced in all the rapid-fire positions. The prone is the most difficult to learn. The sling should be lengthened about two notches more than for slow fire. This is true for the rapid-fire aiming drill, the rapid-loading drill, and the rapid fire itself.

CHAPTER 10.

RAPID-FIRE AIMING DRILLS.

Rapid-fire aiming drills are no different from slow-fire aiming drills, except in the matter of speed. They should always be conducted in rapid-fire time; for instance, ten times in one minute or in one minute and ten seconds, as the case may be. Everything in the ten commandments is done as in slow fire, except that the speed required makes it impossible to use the commands. The same things will be done but without commands except the regular rapid-fire commands. These drills will be done in all the rapid-fire positions, leaving the prone to the last, because it is hardest. They will first be done without dummies, and the loading will be simulated. They will then be

done with dummies until the recruit can execute them easily and carefully within the time limit. He will graduate in these drills by learning to use all the time so that his aiming will be more careful. Stay within the limit, but use all the time.

As noted under rapid loading, the sling should be lengthened about two notches more for this drill than for the slow-fire drill, and the same is true for rapid fire itself. The speed required in rapid fire demands a freer motion, and a longer adjustment of the sling will give it. (Test X, Small Arms Firing Manual.)

After a man has become proficient in the regular rapid fire aiming drill he should be given the "mad minute" aiming drill. In this he loads with dummies and aims and squeezes the trigger as many times as possible in one minute. His speed must always be limited by the care required for good aiming and squeezing.

CHAPTER 11.

SIGHT SETTING.

1. All corrections for sight setting, both for elevation and windage, are estimated in the vertical plane. In other words, the estimate is made on the face of the target and from its center. It should also be made in inches. There is no other unit so convenient and so accurate for rifle fire. The original sight setting for the first shot is based upon the distance from the target. If the elevations of the rifle have not been determined by actual shooting the sight will be set at its normal reading, both for elevation and zero windage. When the shot is fired, if the hit is too high the rear sight will be lowered; if the hit

is too low the rear sight will be raised; if the hit is to the right the wind gauge will be moved to the left; and that is true whether the hit be high, low or at the right elevation; if the hit is to the left the wind gauge will be moved to the right. Therefore, the rifleman must know how much in inches the movement of his sight up or down will raise or lower the hit on the target, and how much the movement of the wind gauge to the right or left will also move the hit on the target. There are two simple rules, easy to remember and approximately correct, which can be used for this purpose. The wind gauge of the 1903 rifle is so constructed that each point of wind amounts to moving the hit approximately 4 inches for each 100 yards distance from the target. For instance, if a hit at 600 yards is 24 inches to the left of the center of the bull's-eye, a movement of the wind gauge one point to the right or where it stood when the hit was made will take the next shot 24 inches to the right and to the center of the bull's-eye, providing the hold, ammunition, and all other conditions were the same. There will, however, always be such variation in conditions as to modify the results of these corrections. The finest windage correction that can ordinarily be used is one-fourth point, and that is 1 inch on the target for each 100 yards distance. The hit on the target is moved in the same direction as the wind gauge is moved, and the wind gauge must be moved into the wind in order to offset its effect.

The second rule relates to elevations, and 100 yards of elevation will approximately move the hit on the target equal to the square of the distance from the target. At 600 yards, if the sight is raised 100 yards it will raise the hit approximately 36 inches; and

if it is lowered 100 yards the hit on the target is lowered approximately the same. If at this distance a hit were 27 inches below the center of the bull's-eye the rear sight should be raised 75 yards in order to bring the next hit up to the center of the bull's-eye with the same hold and other conditions. This is true without reference to whether the hit was to the right or left of the center of the bull's-eye. In actual firing it will be found that these corrections vary because of the differences in holding the rifle and in other conditions. In all cases it must be noted that the corrections for elevation and for windage are independent of each other. If the hit is low and to the left it is necessary to raise the elevation and also to move the wind gauge to the right. The following table gives the more accurate theoretical movement of the hit on the target for a change of 100 yards in elevation up to 1,000 yards; and also the windage movement of the hit on the target:

Range.	Change in elevation of 100 yards moves hit on target—	Change in windage 1 point moves hit on target—
Yards.	*Inches.*	*Inches.*
100	2.88	4.31
200	6.44	8.62
300	11.08	12.93
400	17.28	17.24
500	24.72	21.55
600	34.16	25.86
700	46.68	30.17
800	62.48	34.48
900	79.04	38.79
1,000	99.24	42.11

When a micrometer is used for elevations the graduations usually approximate a minute of angle. The hit on the target is moved one inch for each 100 yards distance from the target for each minute of change.

2. The above table in reference to windage is modified when the battle sight is used. The wind gauge is operated by a rotary movement of the rear sight base, and the distance of the battle sight from the pivot is about one-third less than the distance of the peep sight. Therefore when using the battle sight it is necessary to add about one-third more windage than indicated by the above table.

3. The above description of sight corrections is based upon the presumption that the rifleman hits the target. As a usual thing if he sets the sight for elevation and zero windage as it reads and then makes an allowance for the wind according to windage tables, he will hit the target providing he holds his rifle correctly. In all cases good holding is a necessary starting point for sight setting. At the shorter distances there should be no trouble for the good holder to hit the target the first shot with any rifle, but at mid and long range he will sometimes miss the whole target because of the variation in rifles or because of bad weather conditions. In this case the question of sight setting is more difficult. If he misses the target entirely it is a harder problem to know what to do with the sights. If the wind conditions are strong and unsteady, he is more likely to miss to the right or left. In that event the first corrections should be with the wind gauge. If he is unable to tell whether his hit went to the right or left, then he should move the wind gauge either right

or left, it does not matter which, but enough to move the hit one-half of the width of the target. If he moved the windage gauge right this amount and again missed on the next shot, he should move it the other direction and double the amount; for instance, at 600 yards he missed the target and on his second shot moves the wind gauge 1½ points right from where it was set for his first shot. He again misses, and on the third shot should move the wind gauge back not only the 1½ points but in addition thereto another 1½ points so it would stand 1½ points to the left of his first shot and 3 points to the left of the second shot. This should give him a hit if he missed on account of windage at the first shot unless his first estimate was very wild. If he again misses on the third shot it becomes probable that he is missing for elevation, either over or under. If no hits have been observed in the dirt below the target, it is probable that he is going over. If the weather conditions are good, it is also probable that he is missing for elevation and not for windage. The proper correction to make in this case is to lower the elevation enough to lower the hit one-half of the target, setting the wind gauge at the first and best estimate of the windage. If he misses the target on this shot, then raise the elevation twice as much as he lowered. This should give him a hit and thereafter corrections are made on the hit.

4. From the foregoing statement it must not be inferred that the sight should be set at zero for the first shot when the wind is blowing either right or left. The normal zero of the rifle is taken as the starting point when its actual zero has not been de-

termined by shooting. If the wind is blowing either to the right or left, the wind gauge must be moved into the wind enough to offset its effect, and this must be done by estimating the speed of the wind for the first shot; the rule for this is based on the 9 and 3 o'clock directions. The velocity of the wind is always a matter of estimate. There is no way to get the velocity exactly. Even instruments for that purpose only find it at a particular point, and it may be different 100 or 200 yards away. It is the average velocity over all the ground where the bullet is to go that should be estimated. Having made this estimate, multiply it by the range in hundred of yards and divide by 10; the result will give the setting of the wind gauge in quarter points. For instance, if the range is 600 yards, the wind 15 miles from 9 o'clock; then multiply 6 by 15 and divide by 10; the result is 9, which would mean 9 quarter points, or 2¼ points of left wind. If the direction were 3 o'clock it would be 2¼ points of right wind. If the direction were 2 or 4 o'clock this number of quarter points would be reduced by about one-ninth; and likewise if the direction were 8 or 10 o'clock it would be reduced by one-ninth in the opposite direction. The next hours, 1 and 5, and 7 and 11, reduce it about one-half. The other hours, 12 and 6 do not require a movement of the wind gauge; it stands at zero for both of these directions.

5. While the 12 and 6 o'clock winds do not affect the lateral movement of the bullet and therefore do not require a wind gauge adjustment, they do affect the elevation. The 12 o'clock wind causes greater resistance and therefore causes the bullet to hit lower,

and this requires that the rear sight be raised. However, this effect is very slight at the shorter ranges and becomes important only at the longer ranges.

The following table shows how much a 5-mile wind from 12 o'clock will lower the hit at each distance from 100 yards to 1,000 yards:

Yards.	Inches.	Yards.	Inches.
100	0.012	600	1.260
200	.060	700	2.160
300	.203	800	3.820
400	.343	900	7.120
500	.700	1,000	12.130

In a 6 o'clock wind the hits would be approximately as much higher as they are lower in the above table. As the wind increases in speed the hits would be lowered if the wind were from 12 o'clock and raised if from 6 o'clock, approximately in proportion to the above table for the 5-mile wind. It will be observed that there is no proportion of this variation in hits with the distance because the slowing velocity of the bullet causes a much greater effect in proportion as the distance increases. This makes it difficult to establish a simple rule, except it may be stated that at 1,000 yards a 10-mile head wind requires an increase of 25 yards in elevation, and a 10-mile 6 o'clock wind would require a decrease of that amount.

6. In hot weather and over snow and ice there are certain conditions of light refraction which are commonly called mirage by riflemen. On an ordinary hot day, over the ordinary rifle range, this mirage appears in the form of heat waves, visible to the naked eye,

and much more visible through an observation telescope or field glass. This mirage produces a certain amount of displacement, sometimes in one direction and sometimes in another, depending upon the angle given by the direction of the wind. These irregularities cause a certain amount of disturbance for the rifleman and to some extent reduce his scores. However, the visible mirage is really the friend and helper of the rifleman as soon as he learns to treat it simply as his wind flag. The mirage is only possible in light winds; it is entirely dispelled by wind of about 15 miles per hour; and its effect is always decreased as the wind increases. It can be observed in movement with the wind and is a good index of the speed of the wind. Mirage will disclose wind movements that would otherwise be invisible. The rifleman who has learned to observe these changes and will make slight changes of his sights to offset them, will stay in the bull's eye when his competitor, who does not judge air movement by movement of the mirage, will get 4's or even 3's. The best way is to simply observe these mirage or heat-wave movements for the purpose of determining the air movement, and then change the sights according to the windage rules. Since mirage is strongest in the lightest winds, it often occurs when the wind is changing from right to left. One shot may require a one-half point right wind and the next shot a one-half point left wind. Changes like this can be determined better by observing the direction and speed of the heat waves or mirage than any other way. If at 600 yards the observation of mirage movement disclosed it moving from 9 o'clock at the rate of 5 miles per hour, the sight setting would be 0.69 to the

left, or approximately three-quarters point left wind. If on the next shot the direction changed and the heat waves moved from 3 o'clock at the same speed the sight setting would be three-quarters point right, and the shots would stay in the bull's-eye. This is an extreme case, but such cases do occur. They often occur where the direction switches from right to left, but not the full switch from 3 to 9 o'clock; rather from 11 to 1 o'clock, or 10 to 2 o'clock. The following table shows the number of points of deflection or windage necessary to correct for a 10-mile per hour wind, drift not considered; and for a 5-mile per hour wind the correction would be one-half as much.

Range (yards).	Direction of wind.		
	III, IX.	II, VIII, IV, X.	I, VII, V, XI.
100	0.23	0.20	0.10
200	.34	.31	.17
300	.61	.53	.30
400	.86	.75	.43
500	1.11	.96	.55
600	1.39	1.20	.69
700	1.68	1.45	.84
800	2.00	1.73	1.00
900	2.34	2.03	1.17
1,000	2.67	2.30	1.33

The above table indicates the corrections for mirage in lateral motion. There is one other condition of mirage that should be noted, and that is the boiling mirage. This occurs when there is no wind movement in either direction and no windage is required.

If mirage conditions are frequently recurring it is best to wait until the same condition is seen for each

shot and make no change of the sights whatever. Time is the controlling factor in this method, and if there is not time to wait then the sights must be changed as above indicated.

There are also conditions under which mirage will be observed going in one direction over one part of the range and in an opposite direction over another part of the range. Under those conditions it is often impossible to determine the sight setting except from hits on the target. If the conditions remain uniform the hit on the target is always the guiding point for sight correction, regardless of whether conditions are good or bad. It is the changing conditions that present the problem to the rifleman.

7. A consideration of the aiming point is of some importance to the subject of sight setting, but more especially with reference to the use of the battle sight. For the peep sight the aiming point is at 6 o'clock and on the white part of the target; the hitting point is the center of the bull's-eye. This means an indirect aiming point. In other words, the aim is at one point and the hit intended for another. At 200 yards and 300 yards the aiming point is about 6 inches below the center of the bull's-eye; at 500 and 600 yards it is about 15 inches below the center of the bull's-eye and at 1,000 yards it is about 27 inches below the center of the bull's-eye. This lowering of the aiming point requires a corresponding raising of the rear sight, and in part accounts for the fact that the sights of many rifles must be set at 300 and even 400 yards elevation when shooting at 200 yards distance. At the longer distances the increase in elevation is relatively smaller. The only reason for this

indirect aiming point is the fact that a black sight is seen more distinctly upon a light background, and the rifleman can tell better the exact point at which his front sight is aligned. If the black sight is aligned on the black bull's-eye it is impossible to tell whether it is high or low, right or left. This makes possible a considerable variation in the hold which can not be seen, but it would be seen if the sight were on the light background.

With the battle sight, at 200 and 300 yards the aiming point is still lower, being about 26 inches below the hitting point at 200 yards, and about 28 inches below it at 300 yards. These figures vary considerably with individual rifles and with individual eyes. With many rifles it is necessary to have aiming points at these distances below the entire target. This makes rapid fire much more difficult, and it should be corrected by putting in the highest size of the front sight when possible. It should be observed that the holding or aiming point is about 2 inches lower at 300 yards than at 200 yards. The reason for this is because the battle sight is set at 547 yards and the rising trajectory has not reached its highest point when 200 yards from the muzzle. Since the bullet will rise over 2 inches more in going the next 100 yards it is necessary to hold that much lower in order to hit the same point.

8. The effect of light upon sight setting in an individual question. No rules can be established that will apply to all men alike. In a bright light one man will hit higher and be required to lower his sight; another man will get the opposite result; still other men find no difference. The shade of the sights may

also make a difference in the windage, but this difference may be opposite with different men. If the right side of the front sight is bright and the left side shaded, some eyes would see the right side more distinctly and place it on the aiming point; others would see the shaded side more distinctly and place it on the aiming point. This would make a difference in windage about equal to the thickness of the front sight blade. Such differences may sometimes be avoided by using a sight cover, and sometimes by carefully observing the two sides of the sight when aiming. It is always a good rule to carefully look at the outline of the sights in every kind of light, and such care will often correct error caused by changes of light. In every case each man should learn from actual experience the effect of light upon his own aiming, and then make a record of it and set his sights as his individual case demands. This is one of the most difficult problems in the better training of the rifleman.

Other weather conditions that effect sight setting are temperature and moisture. A change of 7½° in temperature will change the hit on the target 1 inch for each 100 yards distance. If the weather becomes 7½° warmer the hit will be 10 inches higher at 1,000 yards; and the opposite results if the weather becomes colder. In a damp air the hits will be higher, and in a dry air lower. But there is no moisture rule that is reliable like the temperature rule. Many times one set of weather conditions works the opposite of another and thus they offset each other.

In this connection it is also well to note that if glasses are worn they must be kept in a uniform position so the angle with the eye will be constant. A

change of this angle may mean a change of elevations or zero or both. This is more likely to occur with glasses held in place by pinching the nose.

9. Telescopic sight setting has been a source of a great deal of confusion. This can be avoided by bore sighting the rifle. The best method of bore sighting the rifle is to dismount the bolt mechanism, leaving the bolt in the rifle. The aperture for the striker then serves as a rear peep sight in the bore and assists in making the bore sighting accurate. The rifle should then be placed on a sandbag, or, better still, upon an adjustable rest that will hold it firmly in place. It is then carefully sighted through the aperture and the bore, and the bull's-eye of the target carefully put in the center of each. It must remain in this position without being moved, and the telescope sight so adjusted that the center of the cross hairs will cover the center of the bull's-eye at the same time the bore is sighted on the bull's-eye as above indicated. When this is carefully done it gives a practical zero of the telescopic sight for both windage and elevation. The reading of the sight graduations for both windage and elevation should then be carefully noted and recorded as the zero of each. The graduations on the sleeve of the Winchester A–5 telescope represent 25 units corresponding to micrometer readings. Each graduation on the thimble represents one of these units and, therefore, a full turn of the thimble is 25, or the same as a single graduation on the sleeve. The angle of these units moves the hit on the target approximately one-half inch for each 100 yards distance. The windage screw is the same as that for elevation. If after a rifle had been bore sighted and

the elevation sleeve showed 3 red lines and the thimble 9 past the zero point, then the zero of elevation would be stated and indicated as follows: Bore-sighted elevation zero 3+9. If at the same time the windage sleeve showed 4 red lines and the thimble 19 past the zero point then the zero would be designated and indicated as follows: Bore-sighted windage zero 4+19. These two readings having been determined by a careful and accurate bore sight will give a starting point from which any rifle can be easily put on the target up to 1,000 yards. If the wind is blowing the wind gauge screw will be moved to the right or left of the zero, figuring each graduation as one-eighth of a point of wind, which moves the hit one-half inch for each 100 yards distance, as above stated. Therefore, estimate the wind and move the sight into the wind, and to the right or left, exactly as the metallic sight would be moved.

For elevation add together all the numbers of each 100 yards distance up to 600 yards and the sum of these numbers will give the number of units to raise the sight for elevation. For instance, if the distance is 600 yards, by adding all the serial numbers from 1 to 6, inclusive, we get 21; the sight must, therefore, be raised 21 graduations above the bore-sight zero for elevation. This amount of raise together with the jump of the rifle will put the hit on the target. If the distance is above 600 yards it is necessary to add all the serial numbers representing the other hundreds, and 50 per cent more. For 800 yards, therefore, add 7 and 8, then 7 more or one-half of the total of the two. This would give a grand total of 43 which the sight must be raised

above the bore-sight zero for elevation to hit the target at 800 yards. After the target is hit it will generaly be found necessary to make further corrections of the sight, and this should be done until the group of hits is around the center of the bull's-eye and then a record made of the actual elevation and windage used to get this group. This record will be more accurate than the bore-sight zeroes with the calculated changes.

After the elevation is accurately obtained by actual shooting at each distance it is a good plan to again bore sight the rifle with the sight set as it was fired. While the bore is centered on the bull's-eye and without moving the rifle again look through the telescopic sight and observe how far the cross hairs are pointing below the center of the bull's-eye. For instance, at 600 yards it will be observed that the cross hairs are pointing about 60 inches below the center of the bull's-eye. If the number of inches from the center of the bull's-eye down to where the sight points is carefully observed and recorded for each 100 yards distance from the target, and after the sights have been adjusted by actual shooting, it would then be possible to bore sight the rifle upon the target without using any sight graduations whatever. All that would be necessary would be to sight the bore on the bull's-eye and at the same time adjust the telescopic sight to a point the right number of inches below. The windage adjustment must be made as at first indicated herein. This method is not practical above 600 yards because of the greater distance the sight points below the bull's-eye.

CHAPTER 12.

GALLERY PRACTICE.

If there is proper equipment and time, gallery practice has considerable value, because it is real shooting. However, if a man must use a strange rifle with a strange trigger squeeze and complicated with an adapter or reducer for the load, it creates such confusion and nuisance as to almost entirely destroy the value. From a military standpoint gallery practice will not be of much value until each man can use his own rifle with a reduced load that will function the same as the regular load at both slow and rapid fire. Even then a large amount of gallery practice is not desirable for the beginner. The absence of recoil is likely to give him a false idea of the rifle and sometimes good gallery shots become the worst flinchers. Gallery practice should only be considered as a step in the preliminary training. It is an easy method of testing sight alignment, trigger squeeze, and other preliminary instruction. In peace time and for civilian clubs the small bore rifle has great value because of the small expense and the ease with which accessible ranges can be procured.

The animated target affords an advanced course in gallery practice. It is a fascinating sport and it gives some idea of shooting at moving targets. But it is like all other preliminary instruction. It is only a step toward the high-power rifle and must not be substituted. Time enough should be spent on preliminary matters to assimilate the ideas they teach and then put them into the shooting of the military rifle.

CHAPTER 13.

SOLUTION OF RANGE PROBLEMS.

After it has been decided that each soldier should have the best training in marksmanship, after the ammunition allowance has been increased until this training is possible, after the officers have been trained in the best system of instruction, still the whole training is likely to prove inadequate for the following reasons:

A. Inconvenient location of ranges.
B. Insufficient number of targets.
C. Improper arrangement of targets.
D. Inefficient organization for training instructors.
E. Inefficient organization for training the troops.

The range should always be close to camp or quarters. In all cases where this is impossible, the only alternative is to establish a temporary camp at the range during the firing period. While one-half day of firing is sufficient for any one day, still the other duties of that same day should not be of the heavy fatiguing kind. It is impossible to get good results in marksmanship if the men are worn out in long marches or violent exercises. Short marches, light drills, and study periods are desirable, but not during the same half day they are firing.

Men learn to shoot by shooting, and if the number of targets is insufficient for the allotted time, the training will always be inadequate.

The targets should be arranged with reference to the course to be fired. The course should include such

distances and kinds of fire as will best train a man to learn and operate his rifle, to learn and correct his own faults, and to hit under battle conditions. The latter is the final object to be attained, but it is a mistake to attempt the simulation of battle conditions in the beginning. After a man has become a reliable target shot he is then ready for the battle stunts and he will make rapid progress in them. He gets the essential groundwork of all shooting on the targets. He gets it quicker and better if the targets are arranged in logical sequence and for continuous operation. Long experience has shown that for slow fire there should be the same number for targets at each firing point. It has also shown that men should fire at the long ranges as soon as they can hit the targets. When a man can hit the target at 1,000 yards he gets more training out of one shot than out of five at half the distance. It improves him more rapidly for the short distances. In rapid fire it has been found that one-half the number of targets will take care of the same number of men as at slow fire. Therefore, at all firing points where both slow and rapid fire is required, the targets should be in the proportion of 50 slow fire and 25 rapid.

In training troops in marksmanship it is fundamental that all firing should be under the personal direction of an instructor who knows his business. Even if all officers are trained as the best marksmen and best instructors, still they can not give this personal supervision. There are not enough of them. However, there are enough of them to train the noncommissioned officers as instructors, and a school for this purpose should have precedence of all others in war-

time. The organization for this school must fit the range and must include enough students in each unit to provide an instructor for every man when he comes to the firing point.

After these schools are completed the final problem is a firing organization that will give these instructors a chance with their men and give the men a chance to fire the necessary amount during the allotted time. The men must not be hustled and hurried in their firing, but a proper organization will deliver them promptly at the target and conserve the time for the proper instruction in firing.

PROBLEM No. 1: A cantonment, rifle and pistol ranges are to be located and constructed at a designated point for the training of a division in war time.

General situation: The location of the camp is to be governed by the location of the ranges. The terrain is adequate and suitable. In this division there are 18,000 men armed with the rifle and 12,000 armed with the pistol. The training period will be 16 weeks. The ammunition allowance will be as ordered by the commanding general. The Regular Army course will be fired.

Special situation: You will be assistant chief of staff in charge of training the division in marksmanship and are called upon for a report upon the location of rifle, pistol, gallery, and triangle ranges; the number of targets required for each; the arrangement of targets and the firing line; the number of telephones and other special equipment required.

Solution: 1. These ranges should be built on a common firing line parallel to the camp, and at a distance not exceeding 300 yards. North is the best

firing direction, and the ranges should be located accordingly if the terrain permits. If north can not be used, then other directions should be chosen in the following order: Northeast, northwest, east, west, southeast, southwest, south. A change in latitude would change the preference of direction. The direction of fire is of minor importance and will not be permitted to outweigh other important considerations of locating either camp or ranges.

2. There should be 6 firing points for the rifle, beginning on the left of the line, with targets as follows:

No. 1, 200 yards, 75 targets, 8-foot centers.
No. 2, 300 yards, 75 targets, 8-foot centers.
No. 3, 500 yards, 75 targets, 9-foot centers.
No. 4, 600 yards, 50 targets, 9-foot centers.
No. 5, 800 yards, 50 targets, 14-foot centers.
No. 6, 1,000 yards, 50 targets, 14-foot centers.

If for any reason the whole range can not be built, then the long-range targets may be omitted or reduced in number. The others are absolutely necessary if the training is to be efficient.

3. To the right of No. 6 rifle firing point there should be three firing points for the pistol, with targets as follows:

Pistol No. 1, 15 yards, 25 targets, 6-foot centers.
Pistol No. 2, 25 yards, 25 targets, 6-foot centers.
Pistol No. 3, 50 yards, 25 targets, 8-foot centers.

4. To the right of the pistol range there should be two firing points for gallery practice, with targets as follows:

Gallery No. 1, 50 feet, 50 targets, 4-foot centers.
Gallery No. 2, 75 feet, 50 targets, 4-foot centers.

The gallery range will be indoors when practicable, 45 targets to each regiment or equal unit.

5. There should be 50 rests for sighting triangles set at a distance of 100 yards, from 50 sighting boards. These rests will require 10-foot length, 12-foot centers, 3 rifles to the rest, and built for the standing position. This triangle range may be placed on either flank of the firing line, or at any other convenient place near to the camp and the firing line.

6. The targets at each firing point will be numbered serially, beginning on the left with No. 1. Each firing point will also be designated by painted signs at each end of its line, reading "Rifle Range No. 1," or "Pistol Range No. 3," or "Gallery Range No. 2." The triangle range will be designated by the words "Triangle Range," and the rests will be numbered 1 to 50.

7. There should be one telephone on the line, and one in the pit for each 10 targets. There should also be an efficient buzzer for each target.

8. The firing points should be graded level. Sloping is a disadvantage. Behind the 300 yard firing point should be erected a platform simulating the standing trench position for the purpose of firing with the sandbag rest in that position.

PROBLEM No. 2: The same as Problem No. 1.

General situation: The same, except Special Course "C" will be used.

Special situation: The same as No. 1.

Solution: The solution is the same, except there should be 5 firing points as follows:

No. 1, 100 yards, 75 targets, 6-foot centers.
No. 2, 200 yards, 75 targets, 6-foot centers.
No. 3, 300 yards, 75 targets, 6 foot centers.
No. 4, 500 yards, 50 targets, 9-foot centers.
No. 5, 600 yards, 50 targets, 9-foot centers

PROBLEM No. 3: The training of a division in marksmanship in war time.

General situation: The same as for problem No. 1, and with the range constructed and equipped according to the solution of that problem, and the further fact is assumed that all officers have taken the marksmanship course as outlined in this publication.

Special situation: As assistant chief of staff of the division in charge of training the division in marksmanship, you are called upon to report to the commanding general a complete plan of organization for:

A. Training instructors.
B. Operating the range during the training.
C. Training the troops.
D. Operating the range while training the troops.

Solution: 1. A school for training noncommissioned officers as instructors should be organized immediately. Detail for the school:

One officer as chief instructor.

Fifty-four officers as instructors for rifle and pistol.

One thousand noncommissioned officers as students.

One chief range officer.

Five range officers.

Five pit officers.

Forty-eight noncommissioned officers for pit detail.

Five hundred and thirty privates for telephone and pit detail.

2. All of the officers, students, noncommissioned officers, and 70 privates will report to the chief instructor at the range at 7 a. m., the first day of the school, for duty until 12 m. These hours shall be the hours of the school daily, except Sunday. The course

of instruction will be the same as outlined herein, and will continue for four weeks.

3. The chief instructor will divide the students into 50 groups of 20 each, give them serial numbers 1 to 50, and assign an officer as instructor for each group. He will assign a senior instructor and three assistants to pistol instruction. Each instructor will subdivide his group into four firing squads and appoint his four most experienced men as squad leaders, and the leader of squad No. 1 shall also be group leader. He will also designate a group statistical officer.

4. The first three days will be devoted to preliminary instruction of the students in both rifle and pistol and to the instruction of the range officers, telephone and pit details, and to putting the range in readiness. The fourth day the students will fire 10 shots slow fire prone at 200 yards under the personal direction of their instructors, and the squads not firing will continue preliminary exercises under their squad leaders. The fifth day 50 additional pit detail will report, and 10 shots slow fire prone will be fired at 300 yards and 10 at 500 yards, the latter under the personal direction of the instructor. The squads will rotate from one range to the other, and when not firing will be employed as on the fourth day. On the sixth day 50 additional pit detail will report, and the school will fire slow fire prone D target at 200, 300, and 500 yards, the squads rotating and continuing preliminary exercises when not firing. On the seventh day 75 additional pit detail will report and the school will fire slow fire at 200, 300, 500, and 600 yards and slow fire 15 yards pistol. On the eighth day the entire pit detail will report,

and the school will fire slow and rapid fire at 200 and 300 yards, and slow fire at 500 and 600 yards, and slow fire 15 and 25 yards pistol. Thereafter the daily program shall be the record course with 5 shots standing and 5 shots kneeling at 200 yards extra, and pistol at all three ranges. At 200, 300, and 500 yards targets 1 to 50 shall be operated at slow fire, and 51 to 75 at rapid fire. The groups shall be assigned to all slow-fire targets with the same number as the group numbers, and two groups shall be assigned to each rapid-fire and pistol target, and in firing rapid fire and pistol they will alternate man about.

5. Groups will have target assignments for the rifle and pistol as follows:

No. 1, 200 yards slow fire, groups 1 to 50, targets 1 to 50.

No. 1, 200 yards, rapid fire, groups 1 to 25, targets 51 to 75; groups 26 to 50, targets 51 to 75.

No. 2, 300 yards slow fire, groups 1 to 50, targets 1 to 50.

No. 2, 300 yards rapid fire, groups 1 to 25, targets 51 to 75; groups 26 to 50, targets 51 to 75.

No. 3, 500 yards slow fire, groups 1 to 50, targets 1 to 50.

No. 3, 500 yards rapid fire, groups 1 to 25, targets 51 to 75; groups 26 to 50, targets 51 to 75.

No. 4, 600 yards, slow fire, groups 1 to 50, targets 1 to 50.

Pistol No. 1, 15 yards, groups 1 to 25 targets 1 to 25; groups 26 to 50, targets 1 to 25.

Pistol No. 2, 25 yards, groups 1 to 25, targets 1 to 25; groups 26 to 50, targets 1 to 25.

Pistol No. 3, 50 yards, groups 1 to 25, targets 1 to 25; groups 26 to 50, targets 1 to 25.

In the rapid fire, groups 1 to 25 add 50 to their group numbers to get their target numbers, and groups 26 to 50 add 25. In the pistol assignments groups 1 to 25 have the same target numbers as their group numbers and groups 26 to 50 subtract 25 from their group numbers to get their target numbers.

6. At each firing point and for each kind of fire the range officer will place a checking blank and each squad leader will check out when his squad finishes by placing his initials in the proper place. The blank will be in the following form:

Date.....

Range No. ....Fire.

Group.	Target.	Squad 1.	Squad 2.	Squad 3.	Squad 4.
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....

7. The following is the table for rotation of firing squads:

Squad No.	Range No.	Range No.	Range No.	Range No.	Range No.
1.....	1	2	3	4	Pistol.
2.....	2	3	4	Pistol.	1
3.....	3	4	Pistol.	1	2
4.....	4	Pistol.	1	2	3

8. In this organization the number of firing squads is one less than the number of firing points, and if

desired and good squad leaders are available the groups may be divided into five squads of four each, instead of the regular organization of four squads. It will be observed that this system of rotation is flexible and can be made to fit any rifle range.

9. Those who qualify to fire at 800 and 1,000 yards will fire at those ranges during the last 10 days and will omit such other ranges as the chief instructor may direct. During the same time the entire school will do part of its slow fire with telescopic sights. When the long ranges are being fired, additional range officers and pit detail will be ordered. When record is being fired, scorers and additional range officers will be ordered, but during instruction practice each man will keep his own score and report it on a daily card to the statistical officer of his group. The statistical officer will submit a daily report of his group to the chief instructor.

10. This school shall be on duty during a half day of each day and five hours on the firing line. During the rest of the day its entire personnel shall be available for other duties. A second school organized exactly the same will relieve the first school the other half day and also be on the firing line five hours each day and likewise be available for other duties during the rest of the day. If in the short days, one school will relieve the other at midday without intermission in order that each may have five hours of actual firing as near as possible.

11. The details for students in these schools will be proportionately taken from all of the units in the division, including those armed with the pistol.

12. During the progress of these schools preliminary instruction of the troops in both rifle and pistol training will begin and will be so conducted that some units will have completed it before the completion of the school. These units will then be available for firing on the range and all units shall complete their preliminary training before going to the range. The preliminary course of instruction will be the same as in the schools, except that more time will be required.

13. The training of the troops in firing should begin immediately upon the completion of the schools and conducted under the following operation order:

Detail of officers and men for operating the range the same as for each school, and from units not firing.

14. Firing detail, 5 groups each of 250 men. These groups may be designated either by number or by letter and each will be divided into 50 firing squads of 5 men each, numbered 1 to 50, and an instructor trained in the school will be assigned to each firing squad and will have personal charge of it at all times and at all ranges and will form and march it from one firing point to another in the regular rotation. The instructors will be assigned to firing squads from their own units. Company and battalion officers will be in general charge, as near as possible, of their own units. The firing will be done by half days the same as in the school, and a new firing detail of the same number and with the same organization will report for the other half day each day. Each firing detail will continue in this training for a period of 12 half days, and during the time will be available for other duty the other half day. The

range officers and pit detail will likewise be on duty by half days.

15. Each group will have target assignments for the rifle and pistol as follows:

No. 1, 200 yards slow fire, targets 1 to 50.

No. 1, 200 yards rapid fire, squads 1 to 25, targets 51 to 75; squads 26 to 50, targets 51 to 75.

No. 2, 300 yards slow fire, targets 1 to 50.

No. 2, 300 yards rapid fire, squads 1 to 25, targets 51 to 75; squads 26 to 50, targets 51 to 75.

No. 3, 500 yards slow fire, targets 1 to 50.

No. 3, 500 yards rapid fire, squads 1 to 25, targets 51 to 75; squads 26 to 50, targets 51 to 75.

No. 4, 600 yards slow fire, targets 1 to 50.

Pistol No. 1, 15 yards, squads 1 to 25, targets 1 to 25; squads 26 to 50, targets 1 to 25.

Pistol No. 2, 25 yards, squads 1 to 25, targets 1 to 25; squads 26 to 50, targets 1 to 25.

Pistol No. 3, 50 yards, squads 1 to 25, targets 1 to 25; squads 26 to 50, targets 1 to 25.

In all assignments of rifle targets, slow fire, each squad has a target number the same as its own squad number. In all assignments for rapid fire, squads 1 to 25 add 50 to their respective squad numbers for their target numbers and squads 26 to 50 likewise add 25.

In the pistol assignments, squads 1 to 25 have target numbers the same as their squad numbers, and squads 26 to 50 substract 25 to get their respective target numbers.

16. This organization and target assignment will train the whole division to fire the pistol as well as the rifle, and it ought to be so trained. If the 6,000

not armed with the pistol are not permitted to fire it, the men so ruled out will not go to the pistol range with their firing squads. This is better than a separate organization for pistol training and it leaves plenty of room for the officers and men not armed with the rifle.

17. At each firing point and for each kind of fire the range officer will place a blank and as each squad finishes the leader will check out by placing his initials in the proper place. The blanks will be in the following form:

Date.....

Range No. ....Fire.

Squad.	Target.	Group A.	Group B.	Group C.	Group D.	Group E.
1.....	1	.....	.....	.....	.....	.....
2.....	2	.....	.....	.....	.....	.....
3.....	3	.....	.....	.....	.....	.....
...etc...	...etc....	.....	.....	.....	.....	.....

18. The rotation in firing will be according to the following table:

Group.	Range No.	Range No.	Range No.	Range No.	Range No.
A.....	1	2	3	4	Pistol.
B.....	2	3	4	Pistol.	1
C.....	3	4	Pistol.	1	2
D.....	4	Pistol.	1	2	3
E.....	Pistol.	1	2	3	4

During the first day of firing the groups assigned in rotation to begin at 500 and 600 yards shall be omitted from that rotation until after they have fired the shorter ranges. In the regular rotation a firing squad will fire its slow fire at any given range, and then proceed either by pairs or full squad to the rapid fire targets at the same range, and fire its rapid fire, and then proceed as a squad to the next range in the rotation.

19. All men who have qualified for 800 and 1,000 yards will be reorganized into firing squads, and assigned to the best instructors and fire those ranges upon a separate rotation system and in addition to the 12 days' firing hereinbefore prescribed.

20. The firing groups provided in this plan can be increased to maximum of 300, or 6 to a firing squad, or reduced to a minmum of 200, with 4 to a firing squad. The number of groups may be reduced when necessary, and should never exceed the number of firing points. In all cases where odd numbers of men would be left over enough firing squads should be increased to include them.

21. A uniform system of pit details should be followed. All men should have training in the pit. This plan of organization will give each man about half as much time in the pit as on the firing line, and there would be extra pit duty during the schools. All noncommissioned officers and men should be carefully instructed in this plan of organization before going to the range, and also instructed in all of the details and duties of operating the targets. Before one set of noncommissioned officers is relieved the next set should report with them one day for instruction.

PROBLEM No. 4. The same as Problem No. 3.

General situation: The same as Problem No. 3, except Special Course C used.

Special situation: The same.

SOLUTION: 1. The same as Problem No. 3, except the firing at long ranges would be omitted.

2. The rifle target assignments for each group in the training of the troops would be as follows:

No. 1, 100 yards slow fire, targets 1 to 50.

No. 1, 100 yards rapid fire, squads 1 to 25, targets 51 to 75; squads 26 to 50, targets 51 to 75.

No. 2, 200 yards slow fire, targets 1 to 50.

No. 2, 200 yards rapid fire, squads 1 to 25, targets 51 to 75; squads 26 to 50, targets 51 to 75.

No. 3, 300 yards slow fire, squads 1 to 25, targets 51 to 75; squads 26 to 50, targets 51 to 75.

No. 4, 500 yards slow fire, targets 1 to 50.

No. 5, 600 yards slow fire, targets 1 to 50.

3. There should be six firing groups each of 200, divided into firing sections of four each, and the table of rotation would be as follows:

Groups.	Range No.	Range No.	Range No.	Range No.	Range No.	Range No.
A.....	1	2	3	4	5	Pistol.
B.....	2	3	4	5	Pistol.	1
C.....	3	4	5	Pistol.	1	2
D.....	4	5	Pistol.	1	2	3
E.....	5	Pistol.	1	2	3	4
F.....	Pistol.	1	2	3	4	5

4. The firing schedule will also be modified to suit the different ranges. In the preliminary stages the groups scheduled first at 500 and 600 yards will omit

those ranges until they have fired the shorter ranges. After they have qualified to fire at all the ranges the maximum daily schedule will be 10 shots slow and 10 shots rapid at 100, 200, and 300 yards and 10 shots slow at 500 and 600 yards. It is recognized that the mere firing of a prescribed course will not train men to shoot well. They must continue to fire at all ranges and all kinds of fire under proper instruction until they learn to hit. The beginning should be slow and very careful but as fast as the men learn to hit both the distance and the number of shots should be increased. Under this plan 24 men would fire 240 shots on each slow-fire target in 5 hours, and 48 men would fire 480 shots on each rapid-fire target in the same time. By efficient operation of the targets it would be possible to increase the groups to 250 and the firing squads to 5. This would make 30 men and 300 shots to each slow-fire target in 5 hours or 300 minutes, which is about the maximum; at rapid fire it would be 60 men and 600 shots in the same time, but that would not reach the maximum.

5. The pit detail is upon the basis of one man for each target and telephone, ten extra for each pit to prepare and paste targets and for relief and orderlies, with one noncommissioned officer for each 10 targets, one in charge of extra men in each pit, one in general charge of telephones, and two extra for relief. The detail of officers is upon the basis of one chief range officer, one for each firing point and one for each pit, except one range officer and one pit officer for all three pistol ranges.

6. An organization of this kind will train 2,000 instructors through a four weeks' course by half days. A half day in 24 hours is enough of this training. It will give every other man in the division 12 half days and expend about 800 rounds of ammunition per man. This is a minimum allowance for any man who is going into a fight for his life. In addition to this general training 25 per cent of the Infantry should be trained as snipers, which especially calls for firing at the long ranges and at indistinct and moving targets at unknown distances. The expenditure of this ammunition in training means the saving of many times the amount in battle.

CHAPTER 14.

RECORDS.

In order to make the best progress in rifle training particular attention should be given to records. This is especially true when training instructors, and it might also be said that every rifleman should be trained as an instructor.

Notes.—Every student of rifle training should keep a notebook. It can be arranged systematically with numbered subjects similar to the outline herein. Each impressive point of instruction, both theoretical and personal experience, should be noted under its proper number. A well-kept notebook is a valuable asset. The mind is more keenly directed to the matter in point by the writing of the note, and the note does not forget.

very small difference of friction is correspondingly small, and since a difference of friction must exist and since it is small the distance rolled over will be small, comparatively speaking.

INTERIOR BALLISTICS.

Interior ballistics treat with forces and the motion of the bullet in the bore of the rifle.

The primer.—The primer ignites the powder in the cartridge. It consists of the cup, percussion composition, disk of shellacked paper, and the anvil. The cup is made of gilding metal and contains a percussion composition which, when the primer is struck, causes the flash which ignites the powder. The disk of shellacked paper is placed over this composition to keep out moisture and to prevent electrolytic action between dissimilar metals. (Cup and Anvil.)

Powder.—The powder is a pyrocellulose composition. The grains are cylindrical in shape and covered with a thin coat of graphite. The powder charge is from 47 to 50 grains weight. The varying charge is due to one lot of powder developing more force than another at the same temperature; so, to retain force constant the powder charge is varied. Hence, if pressure, or force, driving the bullet remains the same, or constant, the velocity of the bullet remains constant. Therefore, any number of cartridges loaded with different lots of powder have about the same velocity at the same temperature. The graduations on the sights of the rifles are based on the above theory.

The bullet.—The bullet is 0.308 inch in diameter and weighs 150 grains. It is composed of a lead and tin core, inclosed in a jacket of cupro-nickel.

THE PRIMING OF THE CARTRIDGE IN THE RIFLE.

When the cartridge is primed in the rifle and combustion of powder takes place a volume of gases, at a very high temperature, is given off, which attains a breech pressure of 51,000 pounds per square inch. This gas acts along the path of least resistance (which in this case is the bullet) and as the bullet moves forward it is rotated by the rifling about its own axis, and when the bullet leaves the barrel it has a velocity of 2,700 feet per second and the bullet rotates approximately 3,240 revolutions per second at the time it leaves the barrel. The rotary motion of the bullet about its own axis keeps it flying through space point forward. Forward motion and rotation of the bullet begin in breech of barrel with zero motion and rotation, and in the short distance from breech to muzzle attains the above velocity and rotation. The rifling in the barrel makes one turn in every 10 inches to the right.

PARALLELOGRAM OF FORCES.

Composition of two forces not having the same line of action.—If two forces acting on a particle be represented in direction and magnitude by the two adjacent sides of a parallelogram then the diagonal of this parallelogram passing through their point of intersection will represent the magnitude and direction of resultant force. In the above, forces are considered as constant.

The part of the law upon which the above proposition is based may be stated in the following form: When several forces act simultaneously upon a body,

very small difference of friction is correspondingly small, and since a difference of friction must exist and since it is small the distance rolled over will be small, comparatively speaking.

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The part of the law upon which the above proposition is based may be stated in the following form: When several forces act simultaneously upon a body,

each force produces the same effect which it would have produced if it had acted singly. In applying the above principles we may consider the forces as producing motion.

Let us suppose two forces P and Q, Fig. 1, to act simultaneously upon the same particle; each will have the same effect as if it acted alone and is measured by velocity it gives in a certain time and its direction is that of this velocity; therefore, if these velocities are represented by AB and AD, respectively, Fig. 1, then the same lines must be proportional to forces

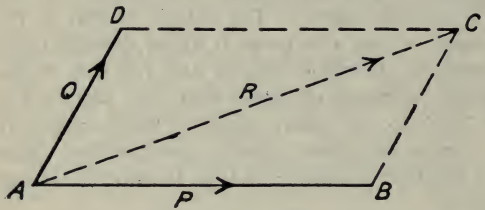


Fig. 1

P and Q. Since AC represents the resultant velocity in direction and magnitude, a force having this direction, and proportional to AC, must be the resultant force equivalent to combined effects of P and Q.

EXTERIOR BALLISTICS.

To apply above principles to a bullet flying through space.—Here we have three, and sometimes four, forces acting on the bullet at the same time. These forces are kinetic energy, air resistance, gravity, and wind.

The *kinetic energy*, in bullet, is result of force of powder gases expended on the bullet at some previous time.

The *air resistance* is due to the bullet forcing its path through the air.

Gravity is the attraction of bullet toward center of earth, which retards the bullet on ascending portion of trajectory and accelerates its fall on the descending portion of trajectory. In a vacuum a body falls about 16 feet the first second and at the end of the first second has attained a velocity of 32 feet per second and its velocity will increase at the rate of 32 feet per second. So, if we could take a rifle in a vacuum 16 feet above the horizontal plane and fire the rifle in a level position, then at the end of one second the

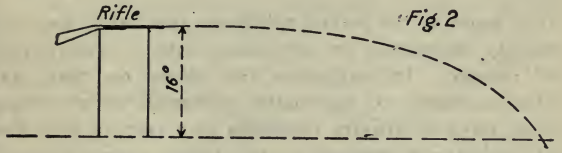


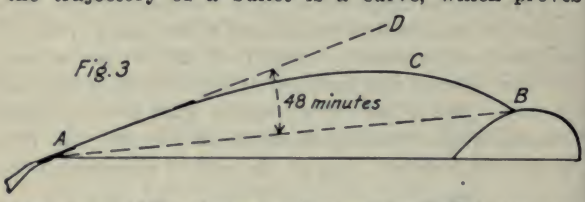
Fig. 2

bullet would strike the horizontal plane a certain distance from the rifle, depending on the velocity of the bullet.

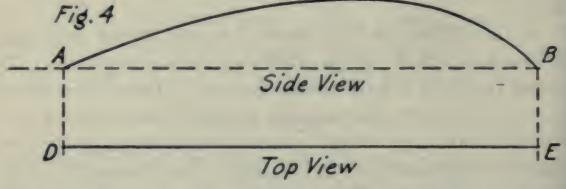
In the above we have seen that the bullet projected in space drops a certain distance in a given time. To shoot the rifle a long distance, near a horizontal plane or level ground, the muzzle of the rifle must be elevated a certain amount to counteract force of gravity and air resistance. For example: Let us assume that we wish to shoot 1,000 yards. For a range of 1,000 yards the angle of departure will be about 48 minutes above the line of site with the model 1903 rifle.

If no other forces acted on the bullet but the propelling force, the bullet would follow path *AD*, Fig. 3, but when the bullet leaves the muzzle of the rifle gravity begins, at once, to draw the bullet toward the

earth and the air resistance begins to retard the forward motion of the bullet. With the three forces, kinetic energy, air resistance, and gravity acting on the bullet, at the same time, the bullet follows a path called the trajectory, *ABC*, Fig. 3. We know that the trajectory of a bullet is a curve, which proves

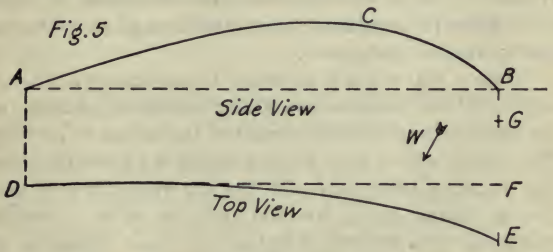


that some of the forces acting on the bullet are constantly increasing or decreasing with a certain rate of change. In analyzing the above we find that kinetic energy of the bullet decreases at a certain rate, force of gravity increases at a certain rate and air resistance changes as the bullet moves forward more slowly, or loses velocity.



Let us assume that we could get a trajectory of a bullet without any side drift (due to a rotation of the bullet) and no side wind blowing. Then the trajectory will lie in a vertical plane, Fig. 4, and top view of the trajectory will be represented by a straight line *ED*, Fig. 4.

Let us now analyze a case where the side wind and drift, due to rotation of the bullet, is considered: The drift of a bullet, fired from the 1903 rifle, is to the right due to the right hand twist of the rifling. Let us also assume that wind acting on the bullet is blowing from left to right, at any angle, but in this case, indicated by arrow *W*, Fig. 5, and that the rifle is aimed at point F, Fig. 5, and fired. We will assume that the bullet struck at *E*, Fig. 5.



In this case (Fig. 5) the side view of trajectory looks like the previous case, but top view has changed so that instead of *DE* being a straight line it is now a curve. This is due to the constant slowing up of velocity of bullet and the action of drift and wind, from the left side, on the bullet. Now, to hit point *F*, Fig. 5, we must point the bore of the rifle at *G*, to counteract the force of the wind, or drift of the bullet, as the case may be. If a strong right wind is blowing it will act on the bullet from the right, and if the drift due to wind is more than drift due to rotation, the bullet will drift to the left.

EFFECT OF HEAD AND REAR WINDS ON THE FLIGHT OF THE BULLET

With a head wind it is not the air resistance alone that must be considered, but we must also consider the velocity with which the air moves toward the bullet. These two combined will give us the force that retards the forward movement of the bullet. Therefore, if a strong head wind is blowing an increase of angle of departure or elevation on rear sight must be increased for a given range to overcome the increased resistance.

When a rear wind is blowing the resistance of the air on the bullet is decreased a small amount, due to the air moving in the same direction the bullet is moving. Therefore, with a rear wind blowing we must decrease the angle of departure, for the air resistance is less. So, in summing up, we find that to shoot a certain distance with known elevation for that distance we must decrease the elevation for a rear wind and increase it for a head wind.

PLOTTING THE TRAJECTORY OF A BULLET.

Every rifleman or any man who will direct the use of the rifle should know all about the trajectory of a bullet under different conditions, and should be able to plot the trajectory without any decided effort when ordinates of respective distances are given. He should know that the trajectory remains rigid if angles of site above or below horizontal plane are small—that is, we may shoot upward or downward, and if the upward or downward angles are small the trajectory will remain the same. He should

also know how to plot wind deflections if tables of wind deflections are given.

Ordinates of trajectory, wind deflection tables, value of correction for temperature and barometer, penetration of the bullet, in certain materials can all be found in the Descriptive Book, United States magazine rifle, caliber .30, model 1903, No. 1923.

A thorough knowledge of these principles should be obtained, as ability to direct fire power and large part of marksmanship and musketry revolves around the knowledge of the characteristics of a bullet in its flight.

EFFECT OF TEMPERATURE AND DENSITY OF AIR ON VELOCITY OF BULLET.

Temperature.—For each degree of temperature above or below normal (70° F.) velocity will vary 1.5 feet for each degree. If we had cartridges which would give us a standard velocity of 2,700 feet per second, at 70° F., and we fired the cartridges when the powder had a temperature of 90° F., our velocity would increase 1.5 feet per second for each degree above 70°. In this case the difference in temperature is 20° and 20 multiplied by 1.5 feet would give us an increase in our initial velocity of 30 feet or a velocity of 2,730 feet per second.

Density of air.—Another factor entering in is the density of the air. The density varies with the barometer, thermometer, and moisture in the air. Tables I, II, III and IV, pages 55, 56, and 57, Descriptive Book U. S. Magazine Rifle, will enable a close approximation to be made for a particular condition.

In Table I, will be found the value of *dl* for different values of temperature and pressures of atmosphere. With value of *dl*, found in Table I, the corresponding elevation for a given range can be found in Table II, which is calculated for different values of *dl*.

With this elevation given in Table II the corresponding elevation can be obtained from Table IV, which gives range and sight elevation for corresponding angles of departure.

NOTE.—In these tables, (*dl*) represents standard density of air 29.92 inches and (*d*) is equal to density of air at time of firing.

The following problem is given as an illustration of the use of the tables referred to above:

Range 1,000 yards; barometer reading 29 inches; temperature 90° F.

FROM TABLE I:

$\frac{dl}{d}$=1.096 for 90° temperature and 29 inches of barometric pressure.

FROM TABLE II:

When $\frac{dl}{d}$=1.10, the angle of departure equals 44.554 minutes.

When $\frac{dl}{d}$=1.05, the angle of departure equals 46.256.

By interpolating:

The difference between angles 46.256 and 44.554 equals 1.702 minutes.

The difference between 1.10 and 1.05=.05.

The difference between 1.10 and 1.096 (the ratio found in this case to represent 90° temperature and 29 inches barometric pressure) equals .004.

Then, by proportion:

$1.702 : X :: 0.05 : 0.004 = \frac{1.702 \times 0.004}{0.05} = 0.136$ minutes, the angle which must be added to angle 44.554.

44.554+0.136=44.690 minutes, the angle of departure when $\frac{dl}{d}=1.096$ and the muzzle velocity is 2,700 feet per second.

TO CORRECT MUZZLE VELOCITY FOR TEMPERATURE OF POWDER.

For each degree of temperature of the powder above 70° F., the velocity of the bullet will increase 1.5 feet per degree, or in this particular case the difference between 90° and 70°, which is 20°. Then: 20×1.5 feet=30 feet, the increase of velocity.

The angle of departure for 1,000 yards, when $\frac{dl}{d}=1$ and the muzzle velocity is 2,700 feet per second, is equal to 48.198 minutes, and for 2,800 feet, muzzle velocity, under the above conditions (when $\frac{dl}{d}=1$) the angle of departure is equal to 44.552 minutes. (See Table III, Descriptive Book.) The difference between these two angles=48.198—44.552, or 3.646 minutes. The difference between 2,700 and 2,800=100 feet, difference in velocity, and 30 is the difference in velocity due to temperature.

Then, by proportion:

$3.646 : X :: 100 : 30 = X = \frac{3.646 = 30}{100} = 1.093$ minutes.

We found that due to conditions in atmosphere (in the above problem) that the angle of departure was 44.390 minutes, but due to temperature of powder we

have an increase of 30 feet in velocity. Therefore, we must decrease the angle of departure by 1.093 minutes, as found above, or 44.690—1.093, which gives us 43.597 minutes, the angle of departure for temperature of the powder at 90° F., and barometer reading 29 inches to shoot at a range of 1,000 yards.

TO FIND THE SIGHT SETTING FOR THE ABOVE RESULTS.

We find, from Table IV of the Descriptive Book, that 43.852 minutes equals the angle of departure for 950 yards and that the angle is greater than the angle found in the above example; so, by interpolating, we find the correct sight setting for the above conditions:

Solution:

Angle of departure, sight set at 950 yards=43.852 minutes.

Angle of departure, sight set at 925 yards=41.786 minutes.

43.852—41.786=2.066, or difference, in minutes, between the two angles.

950—925=25, or difference in yards of elevation.

In the previous example we found that the angle of departure for the powder at 90° temperature and barometer reading 29, for 1,000 yards was 43.597 minutes, and we find from Table IV, Descriptive Book, that the angle of departure for a sight setting of 950 yards equals 43.852 minutes, so the difference between these two known angles would be: 43.852—43.597, or .255 minutes.

Then by proportion:

$$2.066 : 0.255 :: 25 : X = \frac{0.255 \times 25}{2.066} = X = 3 \text{ yards plus.}$$

Therefore this result, 3 yards, must be deducted from 950 yards, which will give us 947 yards sight elevation for firing at 1,000 yards with temperature 90° and barometer 29 inches.

TO FIND THE STRIKING ENERGY OF A BULLET.

Every rifleman should know how to compute the striking energy of a bullet provided he knows the velocity.

The striking energy of a bullet, at any time of its flight, is equal to:

$$\frac{V^2W}{2g}=E \text{ (energy in foot-pounds).}$$

Where—

V^2=Velocity (squared) at any time during its flight,

W=Weight of the bullet (in pounds),

g=32.16 or acceleration due to gravity,

7,000=the number of grains (weight) in one pound (approximately),

and if we know the energy with which a bullet strikes at any given time and do not know the velocity, we can solve for V in the above equation and find the velocity.

Example: Let E energy of the bullet and let its force be known, and we wish to find V (the velocity).

$\frac{V^2W}{2g}=E$, then $V^2=\frac{2Eg}{W}$ and $V=\sqrt{\frac{2Eg}{W}}$, or the velocity the bullet had at the time it struck.

It is not intended that sight corrections will be figured out on the rifle range by these problems.

The simple rules heretofore given in the chapter on sight setting will be used. These examples illustrate the method by which corrections are mathematically computed.

CHAPTER 16.

SAFETY CAUTIONS.

The safety cautions are set out in full in the outline and will not be repeated here.

CHAPTER 17.

RANGE FIRING.

Preliminary instruction is of no avail unless it is used in range firing. The greatest care should be taken by the instructor to see that all of the preliminary instruction is followed when the recruit first comes to the firing point. At this time he is likely to forget even though most carefully instructed. His first shot with the full load is an event and buck fever is often added to his other troubles. A slow, careful start means final speed and progress.

After the ice is broken and a correct start is made, it then becomes a question of plodding, persistent practice. There is no other way to really learn the rifle. All that has been said upon every subject must become a part of the instruction in range firing.

(A) The first firing on the range should always be slow fire, at short range, in the prone position and with the sling. The "ten commandments" should be used for every shot.

(B) As soon as the results of this firing show reasonably good holding then fire for groups at short range. Insist on each shot being held the same and make no sight corrections until after the group is completed. If the aiming point was the same for each shot and the hold good, the shots will all go in a group. Ten shots should be fired in this way, then make a study of the group. If the shots are in a small group around the center of the bull's-eye, the elevation and the zero are correct for that range. If the group is low, the normal elevation is higher. If the group is high, the opposite is true. The amount of change in the sight for normal elevation can be determined by measuring the distance in inches up or down from the center of the group to the center of the bull's-eye and using the elevation table under sight setting. If the conditions are zero and the group is to the right or left the rifle is off for zero. The amount may be determined by measuring from the center of the group to the right or left, as the case may be, in inches to the center of the bull's-eye, and then using the windage deflection table under "Sight setting." There is nothing more important in rifle training than the proper determination of normal elevation and zero windage. They can only be determined by each man for himself by actual shooting and good holding. The result for one rifle is of no value for another rifle. It is a one-man-one-rifle problem.

(C) While the finding of normal elevations and zero windage is best found by firing groups; still it can be well done by a good holder by firing only a few shots. If the time is short it may be necessary to do it this way. In any event it should be carefully done.

Thereafter every shot should be a check on the normal elevations and the zero. They are matters for constant study and observation. They sometimes change because of the wear of the rifle and careful observation will always detect the change.

(D) Rapid fire practice should not begin until after the zero and point of aim for the battle sight are carefully determined by slow fire.

(E) Since marksmanship is developed faster and better by longer range firing it is important to properly increase the range. This can be done as soon as the recruit can hit the target at the longer ranges and correct for at least a part of the distance of his hit from the center of the bull's-eye. He is ready for 1,000 yards when he can stay on the target and get a response to his sight changes. The value of each shot fired at long range for training purposes is very much greater than at shorter ranges. The holding is improved much more and there is no other way to learn weather conditions.

(F) Sniping is the final training of the war shot. It requires a special range. The distances should be unknown and indistinct targets should be used. There should also be moving targets and in fact every form of target that simulates battle conditions. Because of the inadequacy of ranges and the difficulties of operating them the amount of practice to be had is not very great. This is a handicap in the most vital part of the training that can only be removed by the invention of better ranges.

No matter how many riflemen or how many scouts may be attached to an army there is always need for that combination scout and marksman, the sniper.

He must first of all possess those strategic talents which permits the scout to go undetected upon his hazardous missions—even to within a stone's throw of enemy lines. He must be expert rifleman enough to make every bullet bring its hit.

The sniper is in constant battle even when all others on the lines are quiet.

The sniper should dominate no man's land all the time and keep it safe for democracy.

He should dominate the enemy's snipers and protect freedom of movement in his own trenches.

The sniper always fires from cover.

Concealment is his first and his constant necessity.

His post is in or behind his own lines or off from a communication trench. Sometimes it is in front of the lines.

Sniping is often done at less than 200 yards and from that distance up to 800 yards and even more.

Sniping is a one-shot performance.

Snipers often work in pairs, one observing, one shooting.

The sniper knows his distance.

And he is busy during the attack and defense when many of his best opportunities appear.

The sniper has every opportunity to use all the refinements of the most expert riflemen.

He needs an accurate rifle.

He needs the best sight adjustments.

For the ordinary sight the micrometer with graduations that move the hit on the target one inch for each hundred yards distance from the target, both for elevation and for windage, is the best. It should

also have an adjustment for zero in the rear sight. It is not a rapid fire or battle sight.

But part of the snipers must also have telescope sights.

The sniper shoots better with the telescope sight.

The sniper aims quicker than the telescope sight because he sees better.

The sniper aims more accurately with the telescope sight because his target is more distinct.

The sniper will hold steadier with the telescope sight because his errors are magnified and he will fight harder to overcome them.

The sniper will see further with the telescope sight and hit better at longer ranges.

The sniper without a telescope sight has no equal chance against the sniper with it.

The telescope sight will permit the establishment of a second line of snipers at greater distance.

This line will be more efficient because it can be better concealed.

It becomes a support and a protection for the sniping posts closer in and therefore makes all sniping more effective.

The telescope sight should have the same micrometer adjustment before described for the ordinary sight.

The training of the sniper calls for the highest skill in marksmanship.

(G) Record firing is simply a test of the training. So far as the individual is concerned he should fire his record exactly as he fired his practice. Buck fever and all new stunts must be avoided. It is a very bad policy to precede record firing with cautions for extra

care and effort. These should all be given during the training. When the record test comes there is nothing to do but follow the training. The same is true of firing in battle.

CHAPTER 18.

FUNCTIONING AND REPAIRS.

1. To be able to teach the handling of the rifle intelligently, either to officers or enlisted men, it is necessary to know thoroughly the functioning of the various parts of the rifle.

2. Placing a clip of cartridges in the receiver with the clip in the clip slots, they are seated home in the magazine by downward pressure of the thumb, with the fingers grasping rifle, taking care to keep up the pressure in the proper direction until all the cartridges are in the magazine. A release of the pressure or a change in direction of the pressure will result in a jam in most cases.

3. The bolt is in the rearmost position during this process and is held there by the bolt stop pin. The tension of the bolt stop spring is sufficient to hold the bolt in this position when the rifle is held in a vertical position with the muzzle down.

4. As the bolt is pushed forward the face of the bolt engages the head of the topmost cartridge in the magazine, pushing it forward ahead of the bolt. As the cartridge rises out of the magazine the rim of the cartridge slides behind the hook of the extractor, the point of the bullet being guided into the chamber by the ramp in the receiver.

5. As the bolt reaches its forward position and before the bolt handle is turned down the sear notch on the cocking piece engages the sear nose on the sear. As the bolt handle is turned down the two locking lugs on the bolt engage the locking cams in the receiver, giving the bolt a still further slight forward motion, seating the cartridge home in the chamber and completing the full cock by further compressing the main spring. The rifle is now loaded and cocked and ready to be fired.

In squeezing the trigger, first take command of the trigger. In doing this the bearing on the trigger engages the bottom of the sear nose slot in the receiver. As the heel of the trigger comes in contact with the bottom of the sear nose slot of the receiver a distinct stop is felt in the movement of the trigger; with the trigger at this point the edge of the sear nose and the edge of the sear notch are engaged just ready to be released. A further squeeze on the trigger so slight that the movement can not be detected releases the sear notch, and the firing pin is forced forward against the primer of the cartridge by the action of the main spring.

6. To extract the empty cartridge first raise the bolt handle. Several things happen when this is done. The firing pin is forced to the rear by the action of the cam on the cocking piece and the cocking cam in the bolt; this action continues until the bolt handle is almost in its uppermost position. As the bolt handle reaches its uppermost position, the nose of the cocking piece is forced into the cock notch on the bolt. When the bolt handle is about half way up the extracting

cam on the bolt engages the extracting cam in the receiver and causes primary extraction.

When the cartridge is fired it sticks or freezes to the walls of the chamber in a greater or less degree, depending on several conditions, such as the cleanliness and smoothness of the chamber and cartridge, the temper of the cartridge brass, and the temperature of the chamber caused by firing previous shots.

The cocking piece while being forced to the rear by the action of the cocking cams depresses the sear nose, thus compressing the sear spring. This compression is not released until the sear notch passes over the sear nose, at which point the bolt handle is very nearly in its uppermost position.

7. To continue the extraction of the empty cartridge, withdraw the bolt by pulling to the rear on the bolt handle. The parts are retained in position by the cocking piece nose remaining in the cock notch and locked by the sleeve lock engaging its notch in the bolt. The cartridge is withdrawn by means of the extractor hook being engaged in the undercut of the head of the cartridge. Just before the bolt is drawn fully to the rear the slotted locking lug strikes the heel of the ejector, throwing its point suddenly to the right in the lug slot. As the bolt moves fully to the rear the rear face of the cartridge strikes against the ejector point and the cartridge is ejected slightly upward and to the right from the receiver. The bolt is now in the rearmost position and the next cartridge can be loaded as previously described.

8. When the rifle is loaded it may be locked by means of the safety lock on the rear end of the bolt. When the thumb piece of the safety lock is turned to

the left the rifle may be fired. When the thumb piece of the safety lock is turned to the vertical position the cam engages the locking groove on the cocking piece, forcing it slightly to the rear, out of contact with the sear, and locks the firing pin. When in this position the rifle can not be fired for the reason just stated, but the bolt handle can be raised and the bolt withdrawn to the rear to permit the removal of the firing pin from the bolt. When the thumb piece of the safety lock is turned to the right its cam continues to engage the locking groove of the cocking piece, keeping the firing pin locked. In addition to this, the end of the spindle engages the safety lock spindle notch in the bolt which prevents the bolt handle being raised. The bolt is now fully locked and is unlocked by turning the thumb piece to the left.

9. The rifle can be loaded from the magazine or it can be used as a single loader. When the thumb piece of the cut-off on the left hand side of the receiver is turned down and the bolt is withdrawn to the rear, the rear end of the slotted locking lug stops against the projecting end of the cut-off body. The bolt in this position has not passed entirely over the topmost cartridge in the magazine or the follower in case the magazine is empty. Thus with the cut-off in this position the rifle will be used as a single loader.

When the thumb piece of the cut-off is turned up and the bolt is drawn to the rear, the rear end of the slotted locking lug stops against the shoulder at the rear end of the magazine groove on the cut-off. In this position the bolt has been withdrawn entirely over the topmost cartridge in the magazine or the follower. Thus with the cut-off turned up the rifle

will be used for magazine fire. When the thumb piece of the cut-off is in the intermediate position the bolt may be entirely withdrawn from the receiver, the slotted locking plug passing by the dismounting groove of the cut-off.

10. The only phase of the subject "Repairs" that will be taken up in this study sheet is that of "fixing" a trigger.

A large number of the rifles when issued have a trigger squeeze that is not good for accurate shooting.

If, after having taken command of the trigger, there is a further creep, either smooth or by jerks, the trigger should be "fixed," as the best shooting can not be done with it in that condition. To do this we stone down the heel of the trigger. Never for any reason touch the sear nose of the sear or the sear notch of the cocking piece with a stone that will cut. They may be smoothed, but nothing more, and a mechanic must do it.

The heel will be stoned down until the creep that is present after taking command of the trigger disappears. If a coarse stone is used for rapid cutting it should be finished off with a smooth stone to get an absolutely smooth squeeze. In case, through carelessness, too much has been stoned off the heel the distinct stop that is felt at the end of the movement, called "taking command of the trigger," disappears, and the sear notch is released while taking command. In that case the command bearing must be stoned slightly and the notch between the bearing and the heel stoned in if it has disappeared. Careful stoning and handling of the worst of triggers will make a good trigger. During the operation the parts should be assembled

and the trigger squeeze tried several times to insure that the stoning is proceeding properly. If this is done it will be very seldom that it will be found necessary to stone the command bearing.

CHAPTER 19.

INTEREST AND ENTHUSIASM.

This publication does not purport to be a scientific treatise upon all of the details of rifle training. It assumes an elementary knowledge of drills, rifles, ammunition, target ranges, and score books. The things that everybody will learn right anyhow are passed lightly or left unmentioned. It does not present the intricate problems of ballistics nor the mathematics of fire control. Bayonet training is not mentioned.

The importance of these things is not denied and no attempt is made to discourage the best possible training. The American Army is entitled to the best training in all of them. It is getting the best training in all of them.

It did not heretofore get the best training in the greatest function of the rifle, shooting straight.

Too many have believed that shooting, like ballistics, can be taught with blue prints. Too many have believed that straight individual shooting was wholly unnecessary. The war has uprooted these ideas. All who went into the fight with them came out cured. If only once he faced an enemy and his life depended upon his ability to hit first, the solution of that problem was worth many times the cost of training to do it.

Therefore, the first mental attitude is—

A belief in straight shooting.

An enthusiasm for straight shooting.

A pride in straight shooting.

Fortunately, this attitude of mind comes naturally to the American.

It is a part of the traditions of our country.

The instructor easily imparts it to the recruit.

But there are some faults of instructors that need to be noticed. Often great riflemen are not good instructors. The great rifleman knows so well how to do everything that he has a strong mental desire to take the rifle from the recruit and show him how to do it. This is a bad mistake. There is only one reason for taking the rifle out of another's hands. Here it is: *When the recruit is missing and charges the trouble to the rifle.*

In that case it is best for the instructor to take the rifle and convince him it is all right by shooting it.

After that is done the real work of instruction is just beginning. There is no further reason to show him how *you* do it. You must show him how *he* shall do it.

In the very beginning when talking to a class it is well to take the positions, adjust the sling, and illustrate all of the "ten commandments." But that is before they go to the firing line.

On the line *they* do the shooting.

You watch them and learn their faults.

You instruct them how to correct their faults.

You look at the *target after* they have fired.

You look at *them before* they have fired.

Their faults may be little things but *you must see them.*

You fail as an instructor unless you find the faults of the recruit and explain so he can remedy them.

This can not be done with the attitude of the disciplinarian.

It is done with the attitude of the demonstrator.

A recruit will disregard your instructions immediately after they are given, but it is usually unintentional.

Instruct him again.

There is time for discipline after it is certain he is willfully disregarding your instructions.

This is rare, indeed, among recruits.

The sly old shooter who has acquired a bad habit is a more likely offender.

When a great rifleman also acquires the instructing attitude of mind he becomes the best possible instructor of recruits.

His own ability inspires confidence.

But he must instruct and not shoot.

Another personal subject that requires the keenest personal interest of the instructor is flinching.

The causes of flinching are fear of getting hurt, improper placing of the mental attention at the instant of final trigger squeeze, and stage fright, which the hunter calls "buck fever." All sorts of cures for flinching have been invented and many of them will work at times, but some should be prohibited in orders. A close analysis of the causes, a full explanation to the shooter, and a distinct drill or exercise to meet each cause are the only rational cures.

MENTAL DRILLS.

Fear of recoil should be drilled out of each man. How can you do it? Have him take the incorrect

prone position with his body "straight with the rifle." Then take hold of the rifle barrel and jam against his shoulder. It will hurt. Tell him it is due to the position. Then swing his body around 45 degrees. Forty-five is not too much and it does not substantially conflict with the "about 35" of the drill regulations. Get the sling properly adjusted and his face properly frozen to the stock. Again take hold of the rifle barrel with both hands and try to jam his shoulder. It will not hurt. His body is now elastic and gives way to the "jam" of the rifle. The position saves him and will do the same when he shoots. A few drills of this kind will settle the question in his own mind before he ever fires a shot. This removes one cause of flinching.

A more difficult cause is improper mental attention at the instant of firing.

Where should the mind be at this critical moment? How can you train it to stay where it belongs?

This is the most delicate problem in the whole psychology of shooting, but proper understanding and proper attention will put the mind of even the dullest recruit where it belongs—and it belongs on the trigger squeeze. It is all analyzed in the "10 commandments," and each recruit should be instructed until he is thoroughly familiar with every item.

No casual instruction will do this. His mind must be placed on each of the commandments distinctly and separately, but in sequence, and his body must do them not once but many times until he is drilled in all of them.

Some of them are easy and can quickly be learned; but others—the sight alignment and trigger squeeze,

for example—are delicate and not easily understood. He should especially study the trigger squeeze and train his whole mind to control and guide it.

Ten things are a good many to remember and do all at once. The trained rifleman does them automatically and without thinking, but they are an intricate problem to the beginner. Besides, something else is going to happen outside of these 10 things and that is the explosion. That is strictly the business of the rifle and the ammunition, but the recruit is more likely to think about it than about any of the 10 things he must do. His mind must be trained to attention on the things that he does and it must be trained to stay away from the things the rifle does, and especially the explosion. He should neither think, know, nor care when the explosion occurs. It takes an alert instructor to accomplish this result, and here is a sample of what he might say to the recruit in the order of the 10 commandments.

1. You can take your position of 45° without thinking of the explosion. During that time it is easy to think only about the position. The explosion is too far away to get excited about it now.

2. You can adjust the sling above the upper arm and think only about that.

3. See that the butt comes hard on the shoulder and keep your mind on that for an instant.

4. You ought to freeze your face to the stock without explosion alarm.

5. Catch up your breathing, exhale part and hold, and stop your mind at that station. This drill is to teach your mind to halt and about face and advance at the proper time.

6. Take command of trigger, and now you are getting closer to that explosion and the mind may want to jump over and think about the explosion. It must not do this. It must halt and see that the trigger is squeezed back to the first stop and held there.

7. As you align the sights there is plenty for the mind to do without bothering about when the explosion will occur.

8. You can easily reach the last focus on the bull in this same state of mind.

9. Now comes the critical time. The final squeeze is very close to the explosion. The mind now has a still stronger tendency to jump over and think about the explosion. It must be held in check. It must think about the squeeze. The squeeze will not occur of its own accord; it must be directed by the mind. The mind must see that the squeeze is steady, strong, and prompt. If the mind is attending to these things, it has plenty to do without figuring out explosions; and, besides, the explosion performance was all arranged in the factory long ago and needs no mental assistance.

10. Even when the explosion does occur the mind immediately has other business. After final squeeze its next operation is to call the shot. The trained rifleman does not even notice there was an explosion. He heard it, but he did not register it in the record of his achievement. It happened, but it made no impression upon his mind, because he was watching where his front sight pointed at the time he squeezed the trigger so he could call his shot. If the sight was at 6 o'clock he called it a bull, but if the sight moved he called it out in whatever direction the movement

went. He had plenty to do before the explosion and he had plenty more to do after, hence he did not notice it.

This is the training that gets control of the mind and removes one of the greatest causes of flinching.

The mixing of dummy cartridges with loads without the shooter's knowledge is often advocated as a cure for flinching. This is not a cure and is the source of so much danger that it should be prohibited. Dummies and loads should never be mixed. In a particular case a man will flinch and deny it. He is usually honest and does not know it. He may blame the rifle. A dummy cartridge without his knowledge might convince him that he was flinching, but it would not cure. The cure must come after he is convinced, and, of course, it can not come before. He can be convinced by other methods. The instructor can fire the rifle and show him it is all right. He can then pretend to load it, close the bolt, tell him it is loaded, and have him snap on an empty chamber. This will serve the same purpose and avoid the danger of mixing dummies and loads. After he is convinced he must be cured by the mental training before indicated and by giving him a target easy to hit.

BUCK FEVER.

Everybody has it; that is, everybody with any brains. A bonehead might be exempt. It is the anxiety or fear of failure that enters every appreciative mind at the beginning of any new undertaking. It is no discredit to a new man to have a keen anxiety for his success the first time he shoots or the first time he enters a match.

The new man sees the veteran cool and unconcerned and longs to emulate him. This longing itself makes him worse. He becomes ashamed of himself and tries to conceal his anxiety, and therein lies the greatest vice. The dread of being discovered intensifies buck fever many times, and this causes flinching and unsteadiness of the worst kind. In fact, buck fever of the highest degree is a mental illusion of such intensity as to entirely destroy self-control. Can it be cured? Yes. Only a few little things are necessary to dissipate it entirely, but these things must be done in the right spirit and with commanding energy. What are they?

First. The man must be convinced that buck fever is no disgrace.

Second. He must be required to report when he has it, the same as he would report trouble with his rifle or ammunition.

Third. His instructor must talk to him about it as he would any other trouble.

If these three things are actually done it is cured. As soon as a man has discovered his buck fever, reported it, and talked about it, he has mastered it. As soon as his instructor has induced him to do these things he has mastered the finest art in rifle training and gained a psychological control over his man which will be of inestimable value.

Here is a sample course of study for a buck fever school. Assemble the men for a lecture on the subject. Start out by telling them that every intelligent man has buck fever at times and it is no disgrace. Tell them Gen. Bates's story of his first deer hunt. The general says he went out anxious to make a good

showing and quite confident that he would. When he came to the deer country he carried his rifle ready and up near a port arms. He was expecting to see a deer almost any minute and still he did not exactly expect it at the instant it did jump up. There it stood, full broadside, and only 60 or 70 yards away. It would not stand long but it was a beautiful shot, and the great achievement of his first deer loomed large in his mind. He tried to lower his rifle to aim and the rifle would not come down. He pulled on it, swung his weight on it, and it did not come down, and the deer ran away and he never even fired. A genuine case of buck fever. It happened—and it did not happen. The deer was there all right, but the general did not pull down on his rifle—he was pushing up. He was controlled by a mental illusion. He knew it, was not ashamed of it, and cured it by telling about it. It did not happen again.

If every rifleman will look out for his own case of buck fever, not be ashamed of it, report it to his instructor and talk about it he is cured from that moment. A mental illusion can not exist after it has been discovered by the man who has it. He will drop the illusion out of his mind and proceed with the "ten commandments." But if he is ashamed, denies he has it, and tries to conceal it, he will not become a reliable shot in a long time.

After the instructor has delivered a lecture of this type, then let him issue an order for each man to look out for his own case of buck fever and report it immediately in the presence of everybody. He should not stop with an order, but he should require each man to promise on his honor that he will obey the order.

Having received these promises he can dismiss the class. As soon as he is alone he can make a record in his private notes that not a single man in the whole class will keep his promise. They do not intend to be dishonest. They intend to keep their promises. When they come to the firing line they may even notice their stage fright, but they pull out with only the loss of a few points on the score and then persuade themselves that they did not have it. The instructor should pick the oldest and most reliable shooter in the class and have a private session with him. Tell him these promises will not be kept unless somebody leads off. He can then arrange for this man to fire first and get buck fever and report it in the presence of the others, and then all will follow like a flock of sheep. They will report the slightest case and the cases will get slighter after each report, and in a little while will entirely disappear. Their training will assert itself and the "ten commandments" will be kept as a matter of course. These lessons are of very great value in the training of teams for matches.

In this connection it is well to note that no man ever becomes so well trained or experienced but that new and unusual circumstances might give him a bad case of buck fever. Here is an instance. An Olympic rifle champion of the world wanted to coach a State team in the national matches. He was also a good pistol shot and was told that he could not coach the team unless he defeated the State pistol champion in the pistol match. The pistol champion was told the same thing, and then the contest was advertised throughout the camp. Both were old, seasoned shooters, but both came into the match with highly

developed cases of buck fever. The rifleman won his place as coach by a scratch, but both fell down in their scores and were passed by men of very moderate ability. From this it is evident that buck fever can be developed as well as cured by a frame-up. The instructor must learn the human mind and how to guide it. His interest must be personal. He must have this keen interest in every person he instructs. The psychology of such an interest begets an enthusiasm that always means success.

CHAPTER 20.

CRITIQUE AND REVIEW.

A daily critique and review solves each man's trouble for everybody. It is also one of the best methods of making the instruction uniform, and it is impressed more distinctly upon the student's mind. One part of it should always be an inspection and criticism of score books.

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